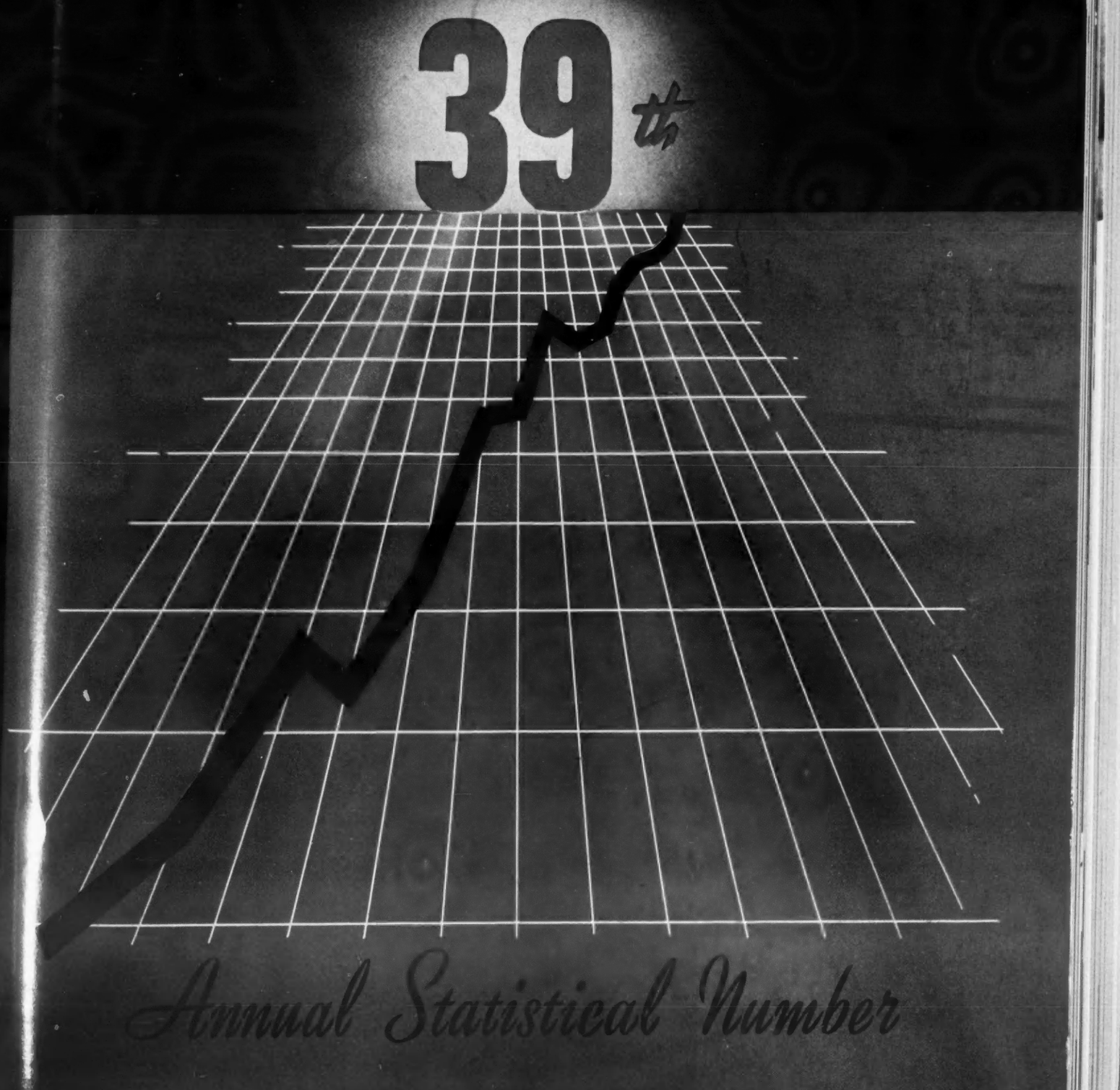
Electrical World

JANUARY 23, 1943



"WE BUY 'EM FOR SERVICING FLUORESCENTS—

—and now every mechanic grabs 'em!"

•

Such FLEXIBILITY in REACH, HEIGHT and MOBILITY makes this the SAFEST, FASTEST MAINTENANCE LADDER ever known

•

You tell us the height and side-ways reach you need and your minimum aisle width—then we'll come back with data on the *one* ladder that will do the safest, fastest, most satisfying service that money can buy. Relamping need not interfere with production. Metropolitan Device Corporation, Brooklyn, N. Y.

Send for the full story in pictures !

Murray crow's nest

METROPOLITAN DEVICE CORPORATION
Brooklyn, N. Y.

Send me data (without obligation) on the Murray Crow'snest best suitable for our requirements. Our ladder must reach_____feet high and extend_____feet side-ways. Aisle width is_____feet.

NAME and TITLE_____

COMPANY_____

ADDRESS_____

Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 69 YEARS

January 23, 1943

Vol. 119 No. 4

UNIVERSITY OF CALIFORNIA
FEB 8 1943
LIBRARY

Contents

39TH ANNUAL STATISTICAL NUMBER

Outstanding Facts 88
Highlights 89
Output 90
Capacity 92
New Capacity 95
Peaks and Capacities 97
Station Economics 100
Coal and Water 102
Customers 103
Energy Sales 104
Revenue 106
Expenses 108
Budget 110
Financial 111
Divestments 112
REA Operations 115
Electrical Manufacturing 116
Chronology of 1942 118

A Survey 119
S. B. WILLIAMS, Editor "Electrical World"

Manufacturers' Output Up 50 Percent 122
MAX McGRAW, President National Electrical Manufacturers Association

Editorials ..... 87 and 124
Washington Comment 126
News of the Week 127
How 139
Load Servicing 170
New Equipment 178
News About People 182
Manufacturing and Markets 194
Recent Rate Changes 200
Sales Opportunities 204
Letters to the Editor 206
Index of Advertisements 216

Price of this issue, $1 per copy

★

S. B. WILLIAMS.....*Editor*

FRANK R. INNES.....*Managing Editor*
A. E. KNOWLTON.....*Associate Editor*
LAURENCE WRAY.....*News Editor*
R. M. SHOOP.....*Assistant Editor*
E. M. GLENNON.....*Assistant News Editor*
D. T. BRAYMER.....*Western Editor*
H. S. KNOWLTON.....*New England Editor*
GEORGE C. TENNEY.....*Pacific Coast Editor*
G. E. DOYING, Jr., *Washington Correspondent*

W. K. BEARD, Jr.....*Publisher*

DISTRICT MANAGERS
E. F. COFFEY.....New York
N. V. PALMER.....Boston
W. K. BEARD.....Philadelphia
F. P. COYLE.....Philadelphia
C. R. LIPPOLD.....Cleveland
S. H. BABCOCK.....Detroit
G. J. SEAMAN.....Chicago
G. G. SEARS.....St. Louis

★

ELECTRICAL WORLD

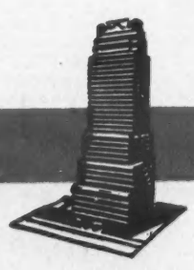
Published weekly. Price 25 cents a copy. Allow at least ten days for change of address. Address communications about subscriptions to Director of Circulation, Electrical World, 330 West 42nd Street, New York, N. Y. Subscription rates: In the United States, Mexico, Central and South American countries, $5 a year, $8 for two years, $10 for three years, Canada, $5.50 for one year, $9 for two years, $11 for three years (Canadian money at par). Great Britain and British possessions, 54 shillings for one year, 108 shillings for three years. All other countries $9 for one year, $18 for three years. Entered as second-class matter November 16, 1936, at Post Office at Albany, N. Y., under the Act of March 3, 1879. Printed in U. S. A.

Contents copyrighted, 1943, by McGraw-Hill Publishing Company, Inc. Branch Offices: 520 North Michigan Avenue, Chicago; 68 Post Street, San Francisco; Aldwych House, Aldwych, London, W. C. 2; Washington, Philadelphia, Cleveland, Detroit, St. Louis, Boston, Los Angeles, Atlanta, Ga.

McGRAW-HILL PUBLISHING CO., INC.
JAMES H. McGRAW
Founder and Honorary Chairman

Publication Office
99-129 North Broadway, Albany, N. Y.
Editorial and Executive Offices
330 West 42nd Street, New York, N. Y.
JAMES H. McGRAW, Jr.....President
HOWARD EHRLICH..Executive Vice-President
MASON BRITTON.....Vice-President
B. R. PUTNAM.....Treasurer
JOSEPH A. GERARDI.....Secretary
J. E. BLACKBURN, Jr...Director of Circulation
Member A.P.B. Member A.B.C.
Cable Address McGRAWHILL, New York

The contents of this issue are copyrighted and may not be reproduced without the permission of the copyright owner.



CHANGE OF ADDRESS

McGRAW-HILL PUBLISHING COMPANY
330 West 42nd Street, New York, N. Y.

Director of Circulation:
Please change my address on Electrical World

From .....

.....

To .....

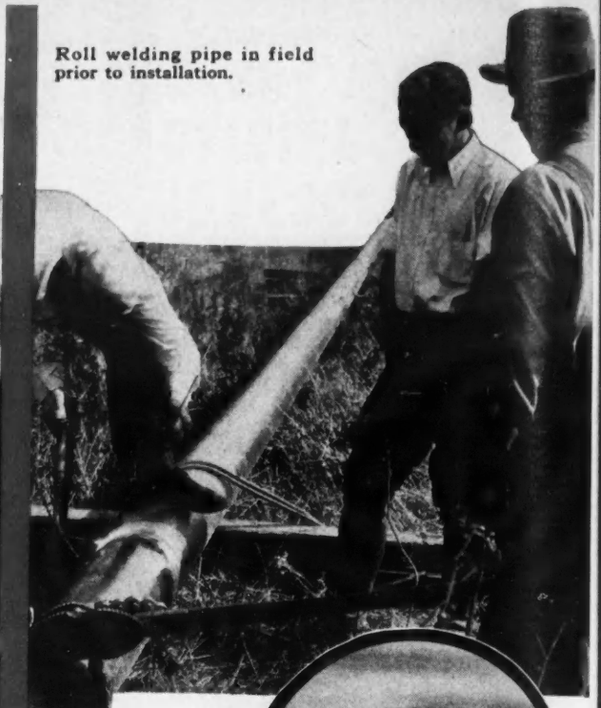
.....

Signed .....

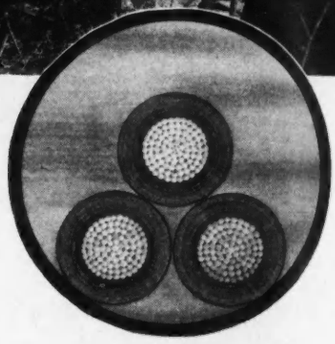
10 YEARS' SERVICE EXPERIENCE

Has Demonstrated The Reliability of

OILOSTATIC



Roll welding pipe in field prior to installation.



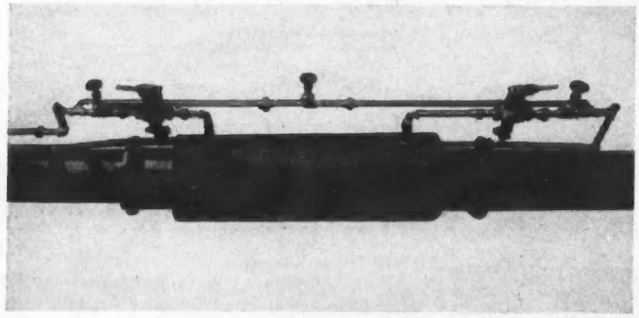
Cross-section of pipe with Oilostatic cable installed.

Ten years ago last October the first installation of Oilostatic in the United States was made at one of the principal substations of the Philadelphia Electric Company. This was the first high oil-pressure cable installation in this country.

The installation has functioned satisfactorily and has demonstrated the service reliability of the Oilostatic Transmission System – developed through Okonite-Callender Research. Since then eight major installations have been or are being put into operation and many refinements have been made available.

Here are the Facts About this Pioneer Installation:

REASONS FOR INSTALLATION: This installation was made in order to demonstrate the practicability of solving mechanically, by Oilostatic, several electrical problems in the transmission of high voltage power. This substation provided a desirable location for making observations, examinations and tests and these have been made from time to time jointly by the utility and the manufacturer.



Sealed under high oil-pressure in a welded steel pipe line, Oilostatic apparently offered distinct advantages for providing higher dielectric strength, and greater insulation stability, as compared with other types of cable. It also eliminated certain lead sheath problems. Its simplicity permitted quick installation.

CABLE DESIGN: The cable consisted of 400 circuit feet of three single-conductor 750,000 C.M. and 1,600 circuit feet of three single-conductor 1,000,000 C.M. each insulated for 66,000 volts with 0.375" thickness of oil-impregnated paper insulation and covered with a metal shielding tape and canvas tape wrapping.

CIRCUIT CONSTRUCTION: This 2,000 ft. installation is operated in series with a 66-kv. 60-cycle aerial circuit between two major substations through manually operated disconnecting switches. After removing the protective temporary lead sheath, the cables were pulled into an 8-inch welded standard steel pipe equipped with one straight joint and three semi-stop joints for controlling the oil flow.

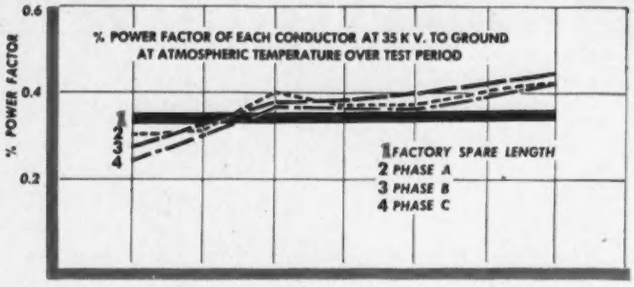
In general, the design of the joints is simple and permits easy construction by regular splicing methods. The pioneer design of the mechanical stop-joint, shown here, readily solved the problem of sectionalizing the oil.

Assembly of pipe above trench.

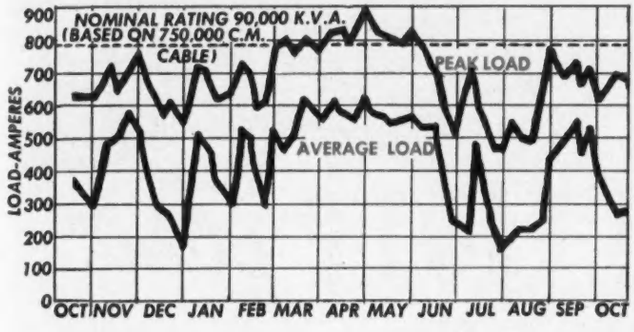
Cold bending pipe to contour of trench.

OPERATIONAL DETAILS: A typical load curve is shown below. Normal interruptions occurred due to switching and occasional outages of the character occurring in the operation of such a line. Otherwise the cable has been in continuous service for the entire ten-year period except for test periods and minor readjustments of an experimental nature during the early period of operation.

RESULTS: (1) The power factor measurements of the cable during the 10-year period apparently indicate the insulation stability of Oilostatic cables. The curves for each phase are shown dotted on the accompanying chart. (2) They check reasonably with factory tests on the spare cable (solid line) which had been kept with lead sheath intact and ends sealed. Comparison of the



two sets of curves indicates that stress and load conditions have affected the electrical characteristics of Oilostatic cable only slightly over this long period. (3) Careful investigations and tests by the utility showed that the steel pipe-line and its protective coating were in excellent condition after ten years.



Peak and average load curves are shown for a typical year. Peak load based on 15-minute interval. Average load based on actual hours of service.

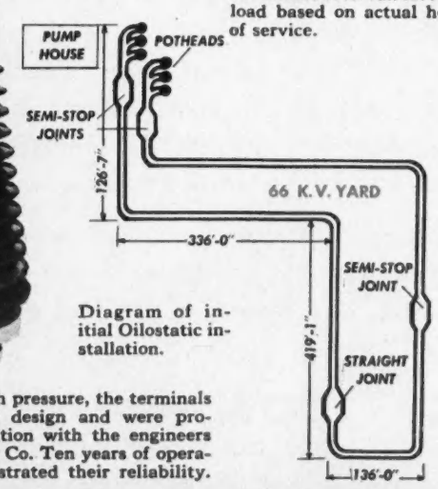
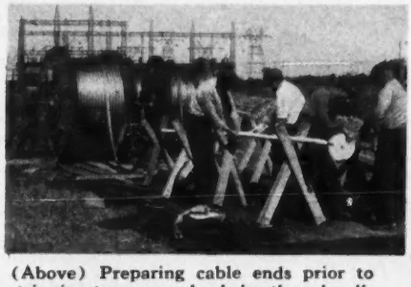


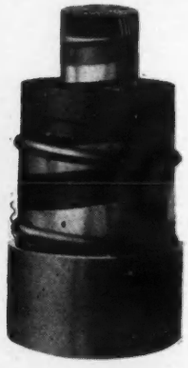
Diagram of initial Oilostatic installation.

To withstand high pressure, the terminals involved original design and were produced in cooperation with the engineers of the Ohio Brass Co. Ten years of operation have demonstrated their reliability.

OILOSTATIC HAS MANY APPLICATIONS: Oilostatic is not offered as a general substitute for the usual pulled-in type of cable construction in which distribution and transmission circuits are carried beneath busy streets. It is designed particularly for higher voltage applications on transmission routes between heavy load centers or adjacent to central and substations. It provides a means for eliminating overhead construction in situations where that type of construction would be difficult or prohibitive. This flexible transmission system will often provide a satisfactory solution for costly and difficult tower and right-of-way problems. For generator and transformer leads at central stations, Oilostatic is being used to save space, conserve copper, and avoid awkward constructions.



(Above) Preparing cable ends prior to stripping temporary lead sheath and pulling into welded steel pipe.



(Right) Latest design of Oilostatic cable.

Ask Okonite-Callender engineers to give estimates on Oilostatic Cable for your next high-voltage installation.

THE OKONITE-CALLENDER CABLE CO., INC.

An Affiliate of The Okonite Company

Executive offices: Passaic, New Jersey

Offices in Principal Cities

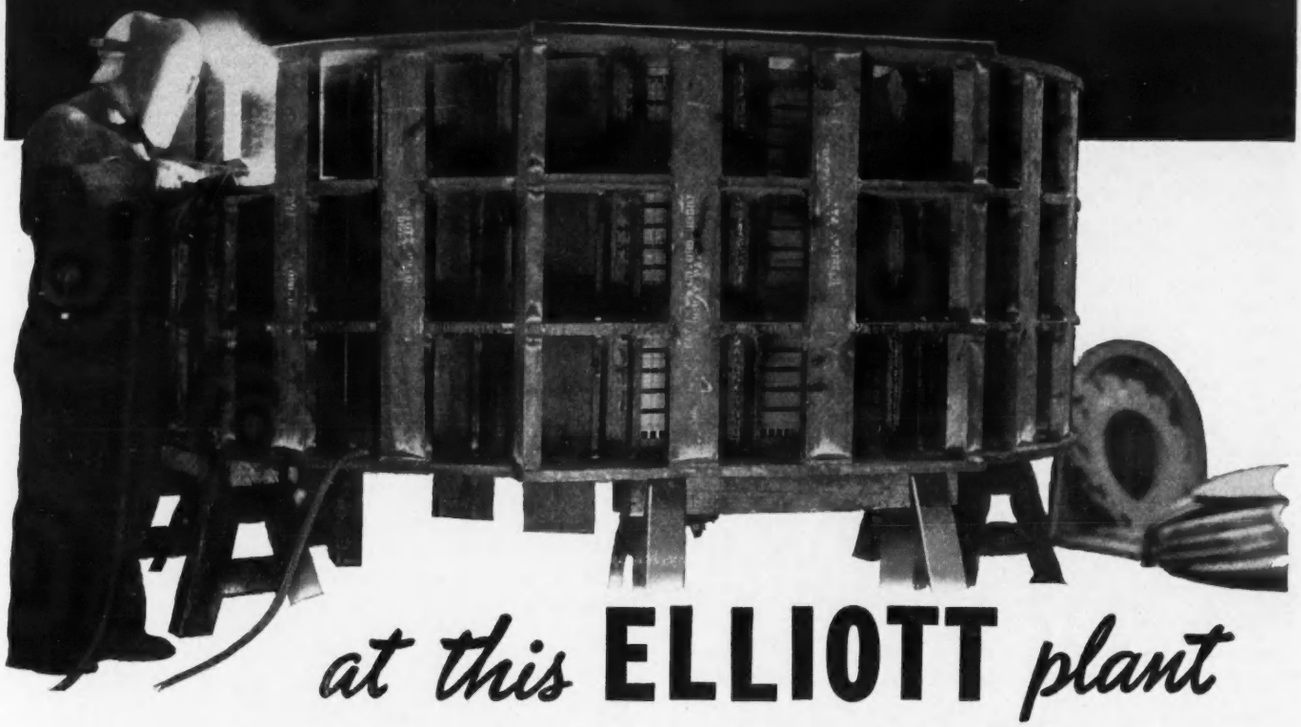
3181

OILOSTATIC ELECTRIC TRANSMISSION SYSTEM

Developed through OKONITE-CALLENDER RESEARCH

They make

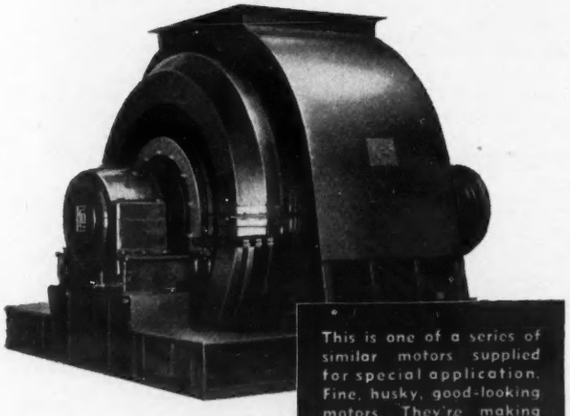
big, strong, powerful motors



at this ELLIOTT *plant*

Sturdy, welded steel frames for rigidity with toughness. Generous factors of safety in bearings and vital dimensions. Improved construction features, such as the Elliott "diamond-cage" winding for extra ruggedness and higher starting torque. Features like these, and a number of others, all add up to the quiet, smooth *power* that the users of Elliott big high-speed motors have learned to expect.

That's the kind of motor you want when you're looking for a motor to handle a particular drive job. And that's the kind they're building at this Elliott plant. Let's discuss it.



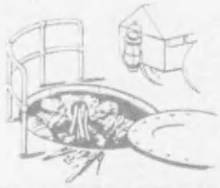
This is one of a series of similar motors supplied for special application. Fine, husky, good-looking motors. They're making fine, husky, good-looking performance records, too.

L-736

ELLIOTT COMPANY
Electric Power Dept., **RIDGWAY, PA.**
DISTRICT OFFICES IN PRINCIPAL CITIES

ELLIOTT MOTORS

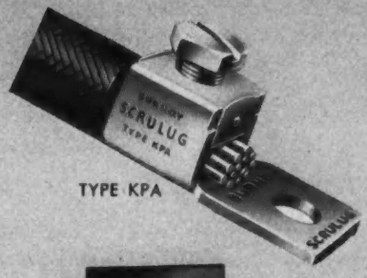
OVERHEAD



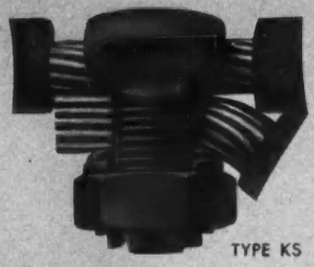
UNDERGROUND

ON THE
BATTLE FRONTS

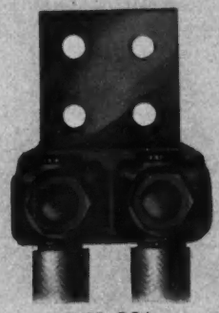
ON THE
INDUSTRIAL FRONTS



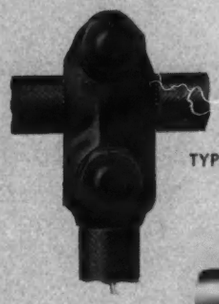
TYPE KPA



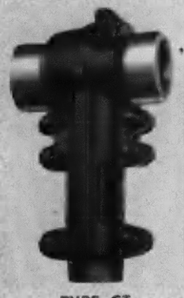
TYPE KS



TYPE Q2A



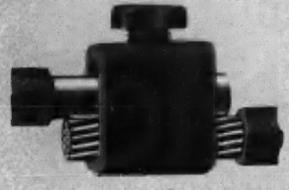
TYPE QT



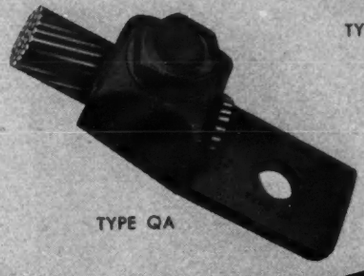
TYPE CT

TYPE QAF

TYPE QPX



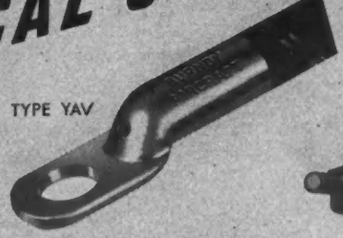
TYPE KP



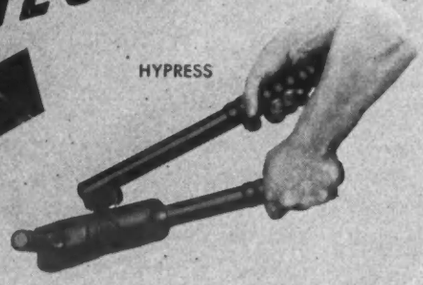
TYPE QA

BURNDY

ELECTRICAL CONNECTORS



TYPE YAV



HYPRESS

107 EASTERN BLVD • N • Y • C

HALF A DOZEN SOUND REASONS WHY O-B BUSHINGS *are Best*

Ohio Brass

2407-H

MANSFIELD, OHIO

Canadian Ohio Brass Company, Ltd., Niagara Falls, Ont.

KEEP BUYING WAR BONDS

The oil expansion reservoir is totally sealed against the entrance of air or moisture that would cause pollution of oil and possible change in electrical characteristics.

A solid non-ferrous diaphragm separates the dial and needle of this gauge from its float mechanism. Movement of the needle is imparted by a magnet. A cause of leakage is removed, the dial never becomes discolored, and the oil is not exposed to sunlight.

Heart of the O-B method of bushing construction is the compression spring. All parts of the assembly are held together by its powerful yet flexible force. Every gasketed joint is correctly loaded for the life of the bushing. Expansion and contraction that could damage gaskets and porcelain fall harmlessly on this massive spring.

No bolted joints are used at the flanges, nor is the porcelain attached to the metal flange by any other rigid connection. Expansion and contraction due to temperature change, that affects porcelain, metal, and gaskets all differently, can cause serious trouble with rigid connections at the large flange area. O-B's method of compression spring assembly totally eliminates this hazard and assures permanently leak-proof joints.

Porcelain internal dielectric, an exclusive O-B design feature, places a rugged insulation where it's needed. The excellent insulating qualities of porcelain are beyond question. It has the added advantages of being absolutely permanent in its characteristics; totally non-absorbent to moisture in any form; non-carbonizing so that possible leakage currents cannot set up low resistance paths and cause future break-down; and made of non-critical material that is easy to get. Condition of the oil does not affect porcelain dielectric. O-B bushings are sealed to protect the oil, not the insulation.

Both top and bottom of all O-B bushings are fully protected by porcelain shells. No interchange of oil is possible between bushing and apparatus tank. The oil level of one does not influence the other. Arc damage to insulation at the lower end is impossible, both due to the protective shell and to the inherent non-carbonizing qualities of porcelain.

HERE'S THE COMING THING
NEW ELECTRO-COOLER THAT
ALLIS-CHALMERS POWER

★ New Allis-Chalmers ELECTRO-COOLERS can step up capacity of most transformers now in service by as much as 60%! Installation is simple, quick, inexpensive!

★ The new ELECTRO-COOLER is self-contained and self-supporting . . . employs no stuffing boxes . . . is self-lubricating. Here's forced-oil cooling at its finest . . . a sound long-term investment.

★ New transformers built with ELECTRO-COOLERS use 25% less copper and steel than formerly . . . cost correspondingly less!

★ When ELECTRO-COOLERS are put on existing transformers, up to four times their own weight in scrapped radiator steel is saved for other essential war uses.

★ This entirely new unit is not to be confused with adaptations of air conditioning devices.

Highlights of
New Electro-Cooler
OIL FLOW
OIL FLOW
Easily installed or removed. If transformer has radiator valves, there is no need even to drain the insulating oil!
Factory sealed! No pipe connections to be made in field.
No glands or stuffing boxes! Oil drips, air bubbles eliminated. No packing to fix.
Only one shaft! Motor and pump are designed as a complete unit — in one frame.
Simplicity! The 3-phase squirrel cage motor has no starting brushes, commutator or other such wearing parts.
Self-lubricated motor and pump are totally oil-immersed.
High-pressure testing eliminates possibility of oil leaks.
Self-contained and self-supporting! No foundations, nor piping, nor connections needed!
THIS NEW SYSTEM IS SPECIFICALLY DESIGNED FOR FORCED-OIL COOLING OF POWER TRANSFORMERS!

ALLIS-CHALMERS

IN FORCED OIL COOLING— JUMPS CAPACITIES OF MOST TRANSFORMERS 20-60%!

Now you can handle increased load without adding any new power transformers!

TODAY almost all U. S. power transformers depend for cooling on slow thermo-syphon flow of insulating oil through their radiators.

By accelerating that flow with pump action — and by forcing cooling air over radiator surfaces — the capacity of those transformers can be sharply increased.

That's exactly the job Allis-Chalmers' new ELECTRO-COOLER was designed to do!

On most transformers, the new ELECTRO-COOLER can step up capacity 20 to 60%. Welcome news in wartime!

Simple to Install

New foundations are not required . . . there's no need to shift transformers. ELECTRO-COOLERS are self-supporting.

Because the ELECTRO-COOLER is factory-assembled as a unit, there are no pipe connections or joints to be made in the field.

Maintenance? It's at a *minimum!* To reduce possibility of oil leaks or seepage, every ELECTRO-COOLER is factory-tested at 50 pounds pressure. (Maximum *working* pressure is only a few pounds!)

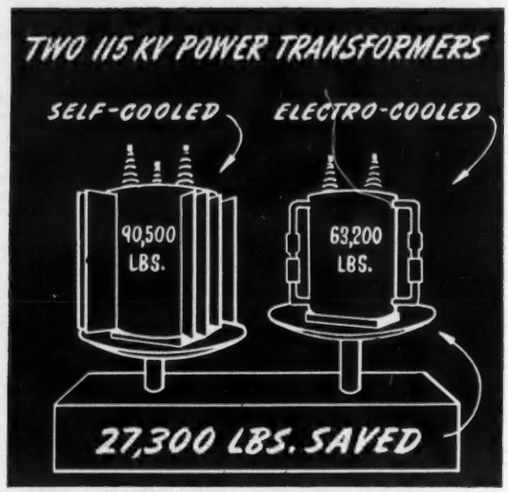
And there are no stuffing boxes to require packing. Motor and pump are built on one shaft and in one frame for greater strength. They're *self*-lubricated!

Big Metal Savings

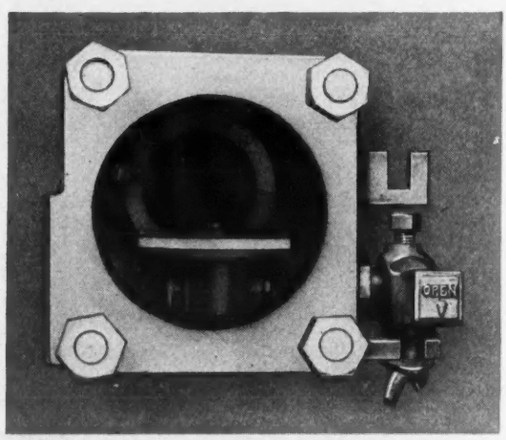
Applied to new transformers, the new ELECTRO-COOLER reduces copper and steel needed by about 25%. Added to existing transformers, it saves up to four times its own weight in scrapped radiator steel for other vital uses!

Here's a wartime investment with a great peacetime future! To learn what the new ELECTRO-COOLER can do for *your* system, call the district office near you. And write for Bulletin B6242. ALLIS-CHALMERS MFG. CO., MILWAUKEE, WIS.

A 1566



Savings like these in copper and steel — an average of 25% — can be made on every contemplated power transformer installation.



No need to drain oil if transformer has this standard radiator valve.

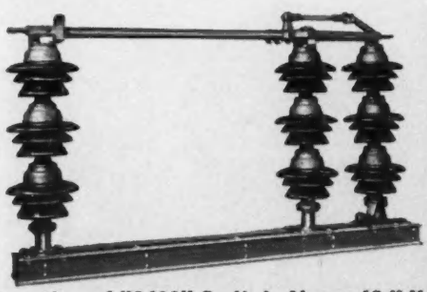
TRANSFORMERS

ALLIS-CHALMERS MILWAUKEE AC WE WORK FOR VICTORY WE PLAN FOR PEACE

YOUR REFERENCE *Guide*

"Three E" 8400 Air Break Switch assures clean positive high pressure contacts

"THREE E" 8400 Air Break Switch has minimum number of electrical joints and current carrying parts. With limiting sleeves at both contacts, 90 per cent of work, wear, strain, and friction is eliminated. You can mount the "8400" switch in horizontal upright, horizontal underhung, 45° underhung, or vertical position—all parts are interchangeable — no additional parts necessary to convert from one mounting to another. Contact jaws are open at the top and bottom and free from dirt or sleet-gathering pockets or shelves. Wiping action is strong enough to break and push aside any accumulation of sleet, ice, dirt, and oxidation, giving clean, positive contacts. Standard units are available in ratings of 400 to 4000 amperes at voltages from 7500 to 287,000. Other sizes can be furnished. See Bulletin No. 327



Construction of "8400" Switch Above 69 K.V.

"Three E" HIGH VOLTAGE SWITCHES and PROTECTIVE EQUIPMENT . . . . . .

OUTDOOR DISCONNECTS

The complete line of standard outdoor hook stick-operated switches are built to meet N.E.M.A. standards with a comfortable margin of safety. Types available are upright and underhung single-throw disconnect switches—double-throw—tandem transfer—double blade transfer—distribution and rural line—line suspension. See Bulletin No. 324.

TYPE 8900 SWITCHES

Vertical break tilting insulator type switches. Write for Bulletin No. 322.

SIDE OPENING AIR BREAK SWITCHES

TYPE 6200

The 6200 type is a double-side break switch having three insulator stacks per pole. The two end stacks each carry a set of jaw contacts. The middle stack carries the blade and rotates to open or close the switch. The blades and contacts are of the same construction as supplied on the "6600" type switch. See Bulletin No. 325.

TYPE 6300

The 6300 type is a single break air break having two insulator stacks per pole. Both stacks rotate, one carrying the jaw contacts and one carrying the blade. The switch is particularly well fitted to installations where phase spacing is limited. This unit is available in all standard sizes and in same ratings as the 6600. See Bulletin No. 325.

TYPE 6600

The 6600 type switch is a single side break air break having two insulator stacks per pole. Available in ratings up to 161 K.V. and 1200 amperes as standard equipment. Higher capacities can be supplied. See Bulletin No. 325.

The 8900 type switches as well as the side opening switches, have full-floating, self-aligning, self-cleaning, wiping type, pivoted Contacts, completely enclosed in Sleet Hood; quick break, non-locking Arcing Horns; ice-proof, corrosion-proof, greaseless Bearings; optional wood or steel interphase Shaft; adjustable Contacts to compensate for any unevenness in the switch frame mounting; and a diversity of base mountings never before possible in any switch.

OUTDOOR HIGH PRESSURE SWITCHES

OUTDOOR TYPE PH

Ratings are to 10,000 amp. Blade operation is identical with that of the indoor type. Supplied in 2-insulator type for stick or gang operation, with locks provided on the stick-operated units.

INDOOR HIGH PRESSURE SWITCHES

INDOOR TYPE PH

Employs high pressure contacts at both ends of switch and is amazingly easy and simple to operate. Furnished in standard units in ratings of 1200 to 6000 amps. and voltages up to 15,000. Other ratings can be furnished.

INDOOR SWITCHES

Safer under short circuits. Maximum contact with cool blade operation. Made in various sizes and styles for pipe and flat mounting, single-throw, double-throw, and gang-operated.

OUTDOOR INSULATING SUPPORTS (Form D)

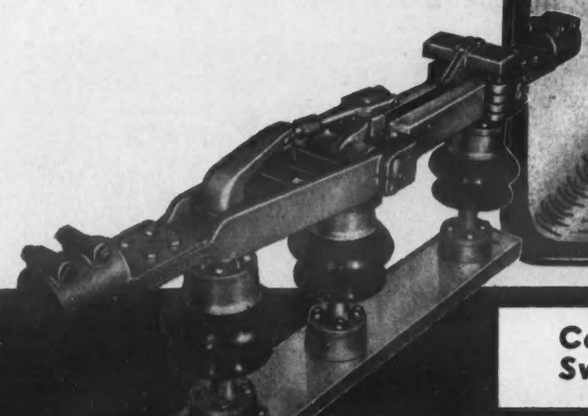
Made in strict accordance with the latest standards of the N.E.M.A. We have adapters for use where it is desired to run a bus at an odd angle to the supporting frame. Bulletin No. 271 gives types, voltages, ratings, and dimensions in inches.

CLAMP INSULATOR SUPPORTS (Type CIL)

Single hole mounting is particularly advantageous where supports are to be mounted on concrete or similar surface. Type MIL is intended for heavy duty service in power houses, substations, industrial plants, mills, mines, etc. Write for Bulletin No. 200.

INDOOR BUS SUPPORTS AND FITTINGS

For carrying any type of bus any way. The complete line up to and including 23,000 volts is made for carrying horizontal or vertical bars and round conductors. Bulletin 226 will give you complete data.



Construction of "8400" Switch Below 69 K. V.

TO LOW MAINTENANCE AND FLEXIBLE INSTALLATIONS

CABLE END BELLS

Individually clamped and gasketed bushings. One piece body with inspection plate* for proper cable equipment. All clamping and fastening bolts are through bolts. Full interchangeability of like parts throughout entire line. Simple conversion to disconnect type by adding disconnect heads. *Not supplied on single pole units or open bushing type potheads. See Bulletin 501, 501-A, and 502.

PIPE STRUCTURE FITTINGS

A complete line of screw and clamp type fittings. See Bulletin No. 111

POWER CONNECTORS

Manufacturers of high quality power connectors for over thirty years. Bulletin No. 401.

INDOOR AND OUTDOOR FUSE EQUIPMENT

A complete line of fuse mountings, Fuse and Resistor Mountings, Fuse Disconnects and combinations. See Bulletins 137 and 328.

See the "Three E" District Representatives Nearest You

Akron, Ohio,
Verne W. Shear & Co.,
354 Dorchester Road.

Atlanta, Georgia,
Walter V. Gearhart Co.,
1067 Stovall Blvd., N. E.

Baltimore, Maryland,
H. M. Wood,
124 Light St.

Beaumont, Texas,
Graybar Electric Co.,
Cypress and Hickory Sts.

Beverly, Mass. (Boston Suburb),
Wm. B. Joyce,
P. O. Box 154.

Buffalo, New York,
R. H. Lydon,
725 Genesee Building.

Cedar Rapids, Iowa,
Fred Farrell,
3741 Center Point Road.

Chicago, Illinois,
Gaide & Dunlap,
327 So. LaSalle St.

Cincinnati, Ohio,
R. M. Heim,
702 Union Central Bldg.

Cleveland, Ohio,
Verne W. Shear & Co.,
4810 Prospect Ave.

Dallas, Texas,
Graybar Electric Co.,
Austin and Wood Streets.

Denver, Colorado,
Graybar Electric Co.,
18th and Blake Streets.

Detroit, Michigan,
E. B. Anderson Co.,
Michigan and 14th St.

Duluth, Minnesota,
Wm. Constable Co.,
3018 E. First St.

El Paso, Texas,
John S. Clark Electrical
Equipment Co.,
P. O. Box 143, Station A.

Fort Worth, Texas,
Graybar Electric Co.,
1605-1607 Commerce Street.

Houston, Texas,
Graybar Electric Co.,
Commerce and Chartres Sts.

Indianapolis, Indiana,
Scott-Jaqua Company,
316 Indiana Terminal Whse.

Kansas City, Missouri,
Henry Nixon,
5701 Wornall Road.

Los Angeles, California,
A. A. Barbera & Co.,
417 So. Hill Street.

Milwaukee, Wisconsin,
Wisc. Elec. Mfg. Co.,
1043 Clybourn Street.

Minneapolis, Minnesota,
L. B. Graves,
602 Wesley Temple Bldg

New Orleans, Louisiana,
Lyman C. Reed,
811 St. Charles Street

New York, New York,
J. Leo Scanlon Co.,
50 Church Street.

Philadelphia, Pennsylvania,
George I. Wright,
528 Commercial Trust Bldg.

Pittsburgh, Pennsylvania,
Robert E. Brown,
311 Ross Street

Portland, Oregon,
Graybar Electric Co.,
Park and Flanders Sts.

Salt Lake City, Utah,
Graybar Electric Co.,
245 So. First West St.

San Antonio, Texas,
Graybar Electric Co.,
Hackberry and Duval Sts.

San Francisco, California,
H. B. Squires Co.,
1277 Howard St.

Seattle, Washington,
Graybar Electric Company
King and Occidental St.

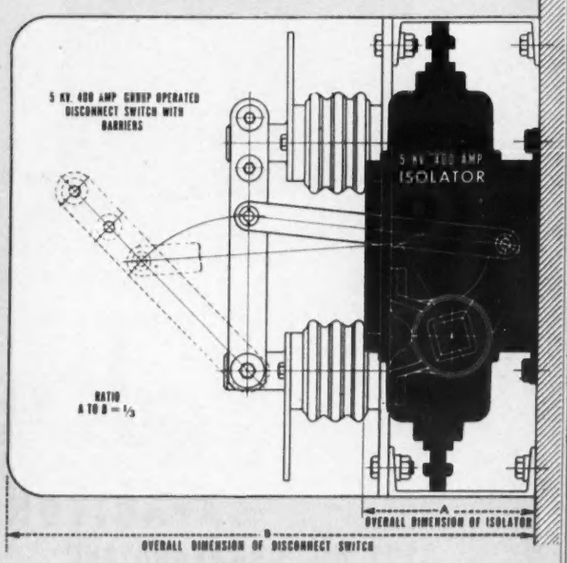
St. Louis, Missouri,
W. L. Rose Equip Co.,
1221 Locust Street.

"Three E" ISOLATORS

for increasing capacity and modernizing of disconnect equipment without increasing space.

The "THREE E" ISOLATOR is a streamlined gang-operated disconnecting switch incorporating many more advantages than a knife blade disconnect. It provides its own barriers completely enclosing all current carrying parts. The ISOLATOR bushings are so designed as to allow easy taping of upper and lower bus connections.

ISOLATORS are extremely flexible for interlocking with other equipment. They can be individually or gang operated, either directly or indirectly—they can be supplied with grounding or test studs, in ratings of from 200 to 2000 amperes and voltages up to 15,000. ISOLATORS are easily adaptable to existing circuits for replacing old equipment. They are built in a great variety of sizes and shapes to meet practically every installation requirement. Write for bulletin.

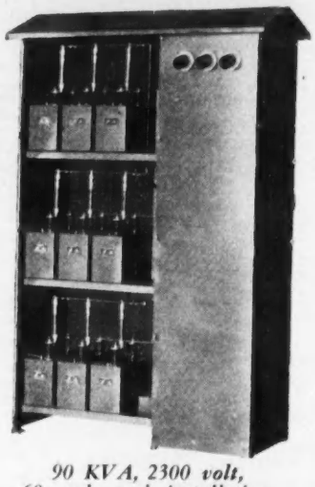

5 KV. 400 AMP. GROUP OPERATED DISCONNECT SWITCH WITH BARRIERS
5 KV. 400 AMP. ISOLATOR
RATIO A TO B = 1/3
A
OVERALL DIMENSION OF ISOLATOR
B
OVERALL DIMENSION OF DISCONNECT SWITCH

ELECTRICAL ENGINEERS EQUIPMENT CO.
MELROSE PARK ILLINOIS

FAST CAPACITORS

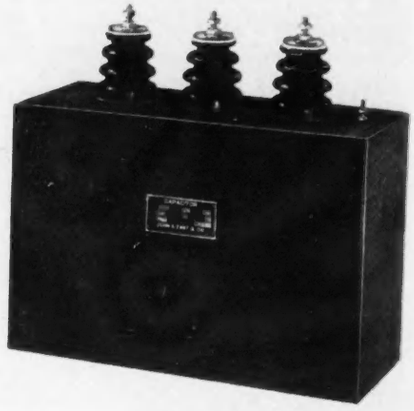
FOR INDUSTRIAL AND UTILITY REQUIREMENTS FOR SPECIAL APPLICATIONS

Higher power factor with a FAST capacitor installation is a good answer to problems of overloaded feeders, low voltage level and high line losses. Power factor correction results in savings that amount to several times the cost of buying and installing capacitors.

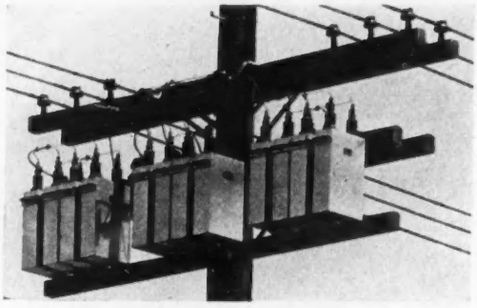


90 KVA, 2300 volt, 60 cycle rack installation.

Rack units come in voltages ranging from 230 to 7200 volts A. C. They are housed in neat, sturdy, welded steel frames for either outdoor or indoor use. Small KVA ratings are installed in compact vertical racks requiring little floor space. Larger installations come in horizontal racks that hold up to several hundred KVA.



15 KVA, 2300 volt, 60 cycle, 3 phase rack unit.



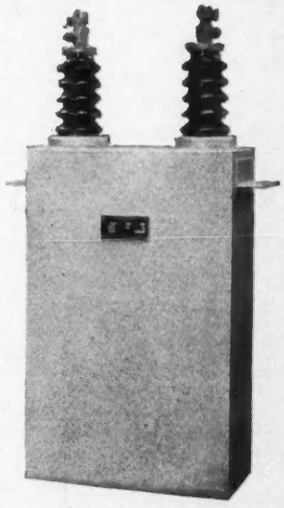
120 KVA, 7200 volt, 60 cycle pole type installation.

Fast dust tight units are designed for installation at each individual machine. They are built in double containers, complete with fuses, discharge resistors, conduit box with multiple knockouts and mounting brackets. Ratings are 3 to 10 KVA at 230 volts. 4 to 16 KVA at 460 and 575 volts, 60 cycles.

16 KVA, 460 volt, 60 cycle dust tight unit.

Small, low loss individual windings, an acetylene welded, hot tinned steel container, three coats of weather-proof paint—these are features of the FAST pole type capacitor. Units are made in 5, 10, or 15 KVA, 2400, 4160, 4800, and 7200 volt 60 cycles rating for either one or three phase application. Standard brackets are available for individual pole mounting or for grouping three or four units.

John E. Fast & Co. has pioneered in the design of many special capacitors to meet the varied needs of its customers. These include special temperature and pressure requirements, special container shapes and sizes, high frequencies and high voltage ratings. The low loss, high stability mineral oil impregnant used in FAST capacitors is of special advantage for unusual heat and frequency demands.



15 KVA, 2400 volt, 60 cycle pole type unit.

JOHN E. FAST & CO.

CAPACITOR SPECIALISTS FOR 23 YEARS

3121 NO. CRAWFORD AVE. **CHICAGO, ILLINOIS**

CANADIAN REPRESENTATIVES: BEAUPRE ENGINEERING WORKS REG'D. 2101 BENNETT AVENUE, MONTREAL FOR POWER FACTOR CORRECTION
J. R. LONGSTAFFE, LTD. 143 BERKELEY STREET, TORONTO FOR SPECIAL APPLICATIONS

MORE THAN A MILLION MILES . . and Still Rolling

KEEPING TRUCKS IN ACTION . . . NOW OR IN NORMAL TIMES . . . DEMANDS THE BASIC QUALITY THAT MAKES THIS KIND OF PERFORMANCE POSSIBLE

Veteran of more than a million miles—and still "on the road" making it's regular hauls—that's the service record of this FWD, owned by Clintonville Transfer Line, Clintonville, Wis. Built in 1933, it has performed continuously since, and is now powered by its third engine—with better than 400,000 miles on each of two previous engines.

This is another of many case histories in the FWD files all testifying to FWD's quality and capacity to haul longer for less—in normal as well as unusual times—in motor transport, highway service, public utility, oil fields, and other services demanding unusual truck performance. And now when wartime truck operation demands every last mile, FWD owners have the advantage of basic, high quality design and construction inherent in FWD's true application of the four-wheel-drive principle.

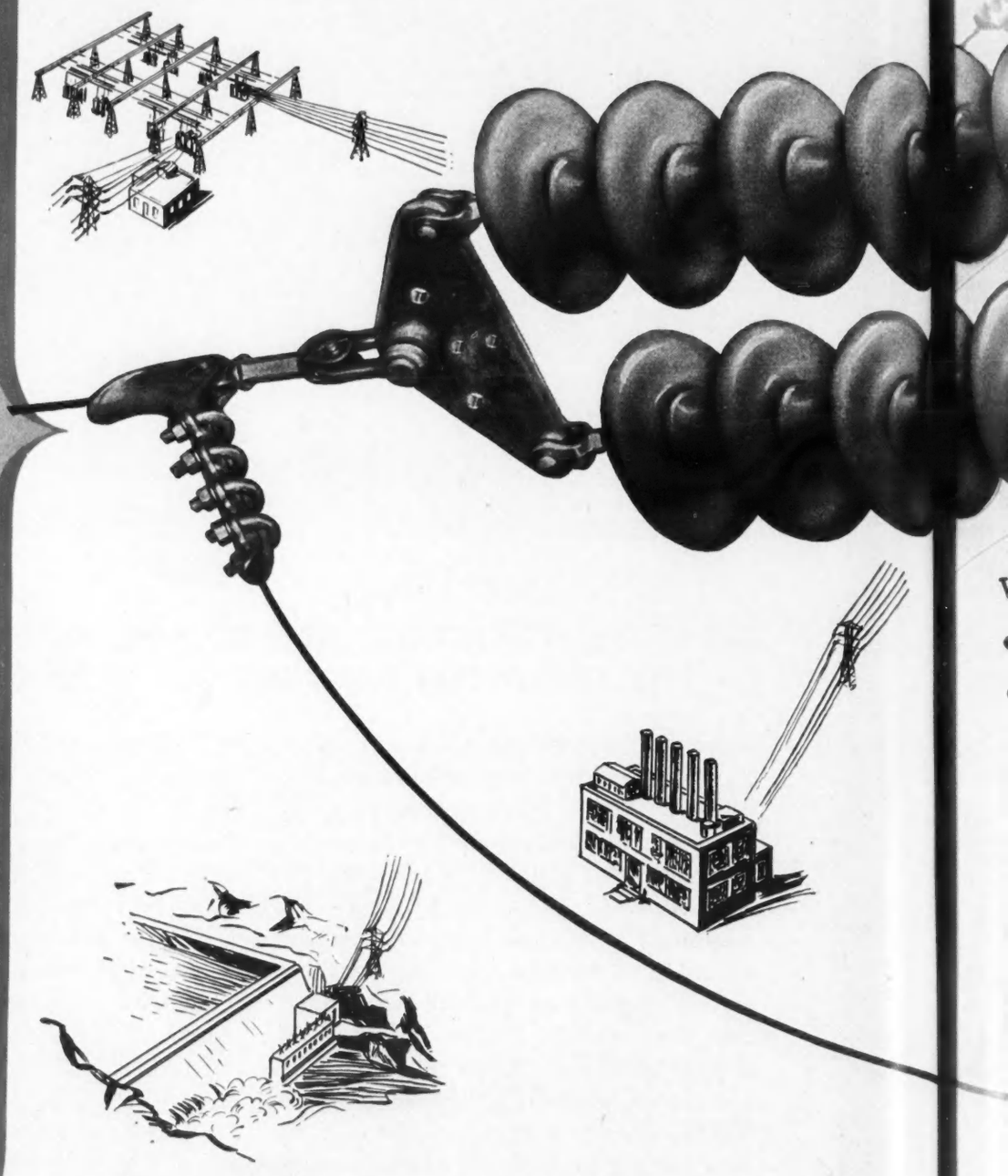
Keep Your FWD's Rolling—
No Matter How Old—
With FWD Service

FWD
TRUCKS

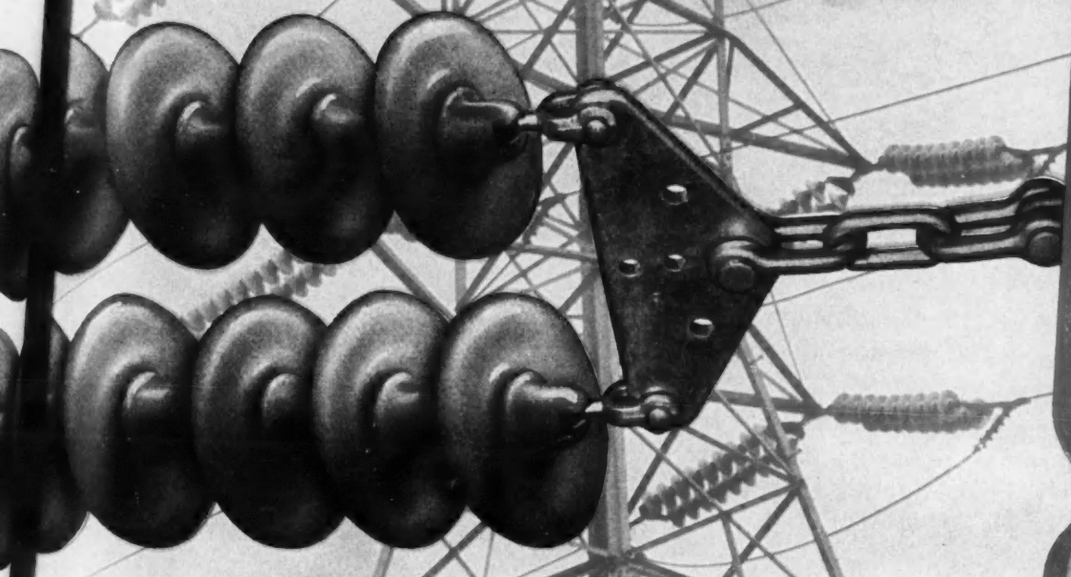
THE FOUR WHEEL DRIVE AUTO COMPANY
CLINTONVILLE, WISCONSIN • Canadian Factory: Kitchener, Ontario

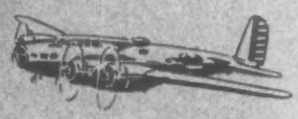
SAGINAW RIVER
QUEENSTON
HELL GATE
SPRINGDALE
BEAUBARNOIS
POWERTON
LONG BEACH
WATERSIDE
SAFE HARBOR
ROCHESTER No. 3
BONNEVILLE
PHILO
NECHES
OSWEGO
L STREET
BAGNELL DAM
NIAGARA FALLS
CRAWFORD AVENUE
BENNING
GORGAS
BATON ROUGE
FORT PECK
SHAWINIGAN FALLS
DIABLO
LONG LAKE
WILSON DAM
SOUTH STREET
WEST END
CONOWINGO
BIG THOMPSON
CONNORS CREEK
ISLE MALIGNE
KEARNEY
STATE LINE
PLATTE-LOUP
LAKE SHORE
HUDSON AVENUE
GRAND RIVER
WAUKEGON
RICHMOND
SOUTH MEADOW
BOULDER DAM
GRACE
GRAND COULEE
CHAS. HUNTINGTON
HARDING STREET
VALMONT
TORONTO
WORCESTER
RIVERTON
STERLINGTON
GLENWOOD
WINDSOR
MILLER'S FORD
NORFOLK
ELM STREET
DEEPWATER
WESTPORT
LAUDERDALE
STATION A
HORSESHOE
TRINIDAD
SHUFFLETON
STAVE FALLS
STATION B
SANTEE COOPER

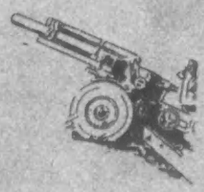
POWER...

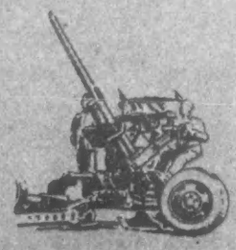


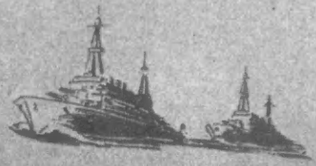
CARRY THE LOAD WITH A FORGING











Vast store of accumulated experience and know-how--- continuous contact with transmission, insulator, and cable engineers --- superior plant and equipment --- trained and interested personnel---at your service. When you are ready to **TAKE IT AWAY** put your Hi-Line materials problem in our lap.

Through your Insulator Manufacturer only.

The Brewer-Titchener Corporation, Cortland, N. Y.

BTC

Forged Hi-Line Hardware

Regular MAINTENANCE of INSULATED WIRES AND CABLES HELPS CABLE PERFORMANCE

★ Insulated cables usually are purchased under specifications that provide for conductors, insulation and protection suitable and adequate for the service they are intended for. Satisfactory service then depends largely upon installation and maintenance. Careful handling, proper equipment and good workmanship will overcome most hazards of installation.

★ Proper design by experienced cable engineers, careful installation under expert supervision, followed by regular inspection and testing, are the best guarantees of satisfactory cable service. But, for the duration of the war, maintenance of cables already in service becomes the major factor in cable operation because new cables are difficult to get and most cable users have no spare cables to install.

★ Careful maintenance is vitally necessary if insulated wires and cables are to continue to function satisfactorily. Regular inspections at frequent intervals, to make sure nothing has happened or is developing to interfere with service, are a good investment. Prompt correction of any unsatisfactory condition will head off complaints and prevent cable failure.

★ In a recent folder entitled "Wire & Cable Maintenance and Conservation of Critical Materials" are a few suggestions designed to aid in keeping insulated wires and cables operating efficiently during the period when copper, rubber and other scarce materials can be used only for war orders and essential industries. We shall be pleased to send a copy to you if you are interested.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge, Mass.

Simplex WIRES and CABLES

He's Keeping a "Weather Eye" on Your WAR-ESSENTIAL Power Lines

Your GRAYBAR Representative is as alert as your own maintenance staff to emergencies of wind and weather.

His help begins before emergencies arise. Although GRAYBAR's local supply stocks are not what they were, he can help you plan ways and means for getting what's critically needed, and suggest alternates to unavailable items.

Should storms strike with damaging severity, the whole network of GRAYBAR "mobilization points" can be called upon for supplies. And you'll get the backing of men from all over the country familiar with utility needs, experienced in helping meet emergencies like the New England Hurricane, the Ohio River flood and blizzards and ice storms beyond count.

Working with GRAYBAR on your day-to-day needs you have all the advantages of an organization in hourly touch with sources of supply across the country, an organization geared to travel the shortest routes through today's priority maze. And when emergencies do strike, you get the help you need . . . come hail or high water.

EMERGENCY "KNOW-HOW"
That Helps You
BEAT THE SLEET

PLANNING "KNOW-HOW"... based on GRAYBAR experience in emergencies dating back before the Blizzard of '88 and extending through three wars.

DELIVERY "KNOW-HOW"... backed by a nationwide network of warehouse facilities and the means for getting what's available to the point where it's most badly needed.

COORDINATION "KNOW-HOW"... resulting from long successful experience in serving *both* manufacturers and utilities.

MANPOWER "KNOW-HOW"... evidenced by the more than 20 years average experience of GRAYBAR Managers and Specialists.

GraybaR

IN OVER 80 PRINCIPAL CITIES

GRAYBAR Quality Since 1869 * REG. U.S. PAT. OFF

Everything Electrical .... THAT IT TAKES TO WIN!

Executive Offices: **GRAYBAR BUILDING, NEW YORK, N. Y.**

VARNISHED CAMBRIC · RUBBER POWER CABLES · BUILDING WIRE · RADIO WIRES · SIGNAL CABLE · FLEXIBLE CORDS · LEAD-ENCASED AND PARKWAY CABLES · ARMORED CABLE

CRESCENT

ANSWERED THE CALL

CRESFLEX NON-METALLIC SHEATHED CABLE · SERVICE ENTRANCE CABLE · MAGNET WIRE · BARE WIRE

Long before Pearl Harbor we were in total production for Defense. Now we are in

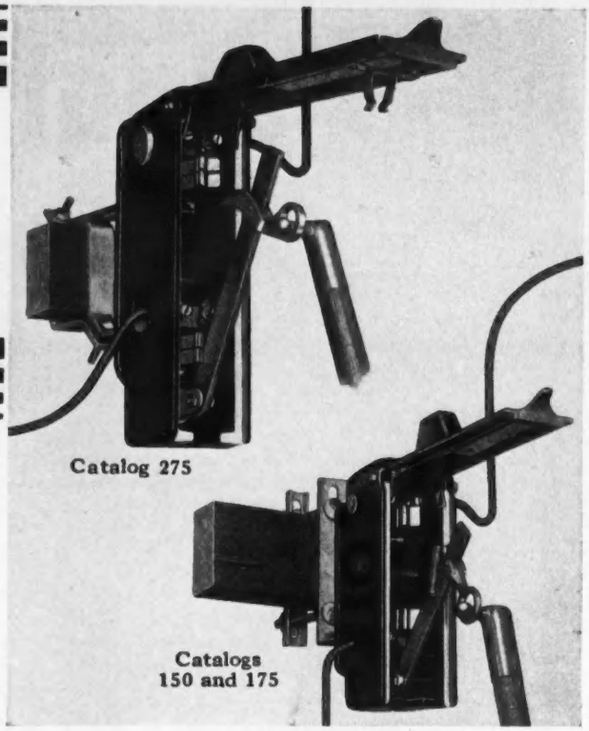
Total Production for War!

CRESCENT INSULATED WIRE & CABLE CO.

CRESCENT
WIRE and CABLE
Factory: TRENTON, N. J.—*Stocks in Principal Cities*

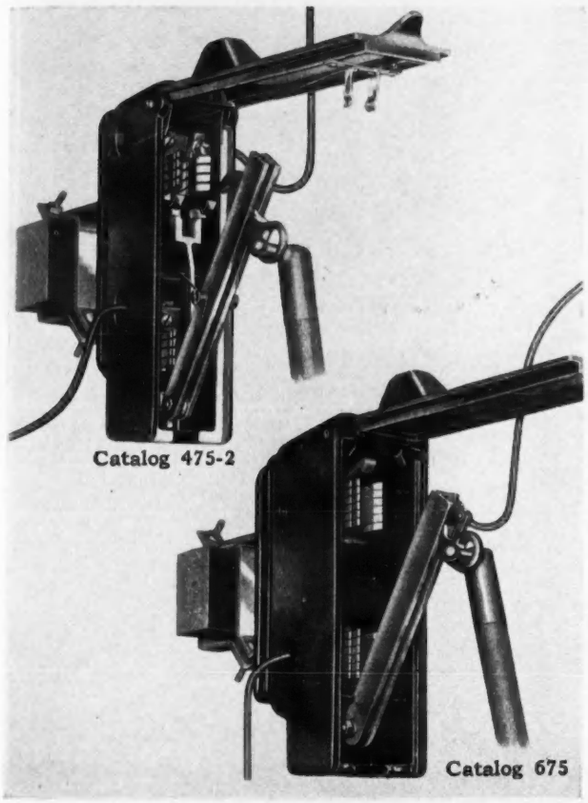
CRESCENT ENDURITE SUPER-AGING INSULATION · WEATHER-PROOF WIRE

SAFE
STURDY
COMPACT



Catalog 275

Catalogs
150 and 175



Catalog 475-2

Catalog 675

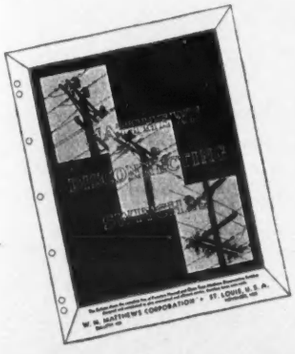
They are SAFE.—These switches are of the dead blade type, have ample insulation values, will not over-heat and will cause no radio noise interference at operating voltage.

They are STURDY.—Heavy bus bar copper blades, large copper contact clips reinforced with phosphor bronze retainer clips, positive clamping terminal connections and strong moulded bakelite doors assure year in year out service.

They are COMPACT.—On crossarm or vault installations where limited space is a factor, they can be more readily installed.

Porcelain Housed Matthews Disconnecting Switches are available in the following sizes:

100 Amp. 5 Kv. — 100 Amp. 7.5 Kv.
200 Amp. 7.5 Kv. — 400 Amp. 7.5 Kv.
600 Amp. 7.5 Kv.



Bulletin 106 fully describes Matthews Disconnecting Switches

Ask for your copy

W. N. MATTHEWS CORPORATION
SAINT LOUIS, U. S. A.
ENGINEERS and MANUFACTURERS SINCE 1899

What's going on at

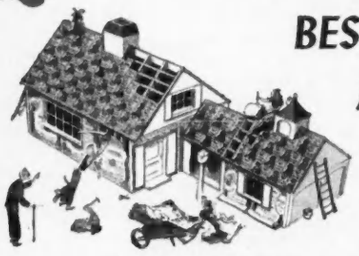
BACK-TO-SCHOOL SPECIAL

Step right this way, folks, and see G.E.'s new *three* R's —repair, replacement and the right care of G-E appliances. Thousands of *new* service people are being trained to keep irreplaceable G-E appliances working for the duration. The war raided the ranks of service men, so new ones had to be trained and G.E. was the first to conduct such "Service Schools." Thousands of service experts are being turned out. Here's another opportunity for the G-E Dealer to keep going as appliance leader in these keep 'em working times. Ask your G-E distributor for current training school dates for your city.

OUR NEW "SERVICE" DEPARTMENT

Right after Old Glory, we're proud of this flag that's flying at every G-E plant. Over 15,000 former G-E'ers now serving Uncle Sam! We're proud of the lot of them, boys and girls, and we're going to keep working our heads off to keep them proud of us.

BEST BUY IN AMERICA



(this illustration is part of our Jan.-Feb. national ads.)

War Bonds! Bonds today for homes tomorrow! Uncle Sam urges everybody to buy War Bonds now and use the accumulated savings as a nest egg to help build and equip new homes *after* the war. G-E advertising (as you can see) is right in step with the government's wishes. Goes even farther, in fact, by pointing out how the G-E Consumers Institute is helping *now* to plan the better living that's to be built into tomorrow's Victory Homes.

AVIATOR'S CLASSIC

Fine, soft-spun woolens with wires, for snug fit and automatic warmth without weight. You guessed it! The famed General Electric Blanket goes to war as high-altitude flying suits for U.S. Airmen. This wartime experience adds up to a slick post-war sales story for dealers and salesmen.

WEAPONS FOR VICTORY!

G.E.'s war workers, 165,500 strong, are turning out a lot of weapons for victory. A lot of fighting tools to help our boys win, and come back to a better America. There's probably some G-E equipment on every ship, plane, tank and armored car making up the U.S. war machine. It's our part of America's will to win.

GENERAL ELECTRIC

WAR BONDS WILL BUILD AND EQUIP

Headquarters?

All General Electric manufacturing facilities and people are under orders. Uncle Sam's orders. Twenty-four hours a day, seven days a week, holidays and all. It's a full-time, all-time, on-time job.

Don't think we've forgotten you, though. G.E. keeps on building good will for G-E Dealers. The G-E Consumers' Institute is making lasting friends for you . . . now and postwar!

General Electric advertisements—*your advertisements* — appear each month in national magazines. Read them. Talk about them. Tell your friends about them. Tear them out and hang them for all to see. Use this monthly check list to find them fast.

MAGAZINE	DATE ON NEWSSTAND	ISSUE DATE
Saturday Evening Post	Jan. 6	Jan. 9
Collier's	Jan. 29	Feb. 6
Life	Jan. 29	Feb. 1
Ladies' Home Journal	Jan. 28	February
McCall's Magazine	Jan. 29	February
Better Homes & Gardens	Jan. 27	February
House & Garden	Jan. 20	February
Household Magazine	Jan. 18	February
Woman's Day	Jan. 22	February
Successful Farming	Jan. 19	February

The G-E Institute Extended to Meet U. S. War Needs

General Electric Consumers Institute Proves Its Wartime Worth On Home Front

To an earnest group of scientists, engineers and home economists at the General Electric Consumers Institute in Bridgeport, Conn., rightfully goes credit for a behind-the-scenes story of ingenuity and hard work; coupled with a very definite devotion to duty.

Long before Pearl Harbor, the Institute began the conversion of its manyfold homemaking activities to meet the needs of a nation rapidly preparing to live under a defense economy.

With the actual outbreak of war the work of the Institute took on an importance that soon rated it as an outstanding service to homemakers in wartime. From the Institute's laboratories, experimental kitchens, and test laundries have come a steadily increasing flow of facts and practical help for America's housewives and mothers on the Home Front.

Consumer Needs Foreseen

The people who man the Institute take the long-range view of the war picture and consequently have anticipated most of today's needs long in advance of actuality. Institute's Economists are out ahead of the times with practical information on Food Conservation; Menu Planning for War Worker's Meals and lunch boxes; Nutrition for the average family; time and money saving ways to buy and prepare foods; new facts on latest food processing methods such as dehydration and quick-freezing, etc.

Test Labs Work Overtime

Over in the Institute's test laundries there are research experts who actually make a science of clothes-saving based on correct washing, ironing and mending methods. Since the conversion of the entire appliance industry to war production, the Institute has intensified its engineering studies of the proper use and care of appliances in the home, to make them last for the duration. About the only thing the war has left untouched in the Institute's sixteen year history, is their method of making the results and findings of their research and study available to all homemakers.

These facts are still regularly published in the Institute's handy, practical booklets and pamphlets and offered to any homemaker free of charge. The war has, however, greatly increased the number of different booklets now available. Consumer consultations in the field and at headquarters are being continued as in the past, but with wartime topics as their discussion basis.

It's a great tribute to the people of the Institute who have stuck to their guns in order to help America's Homemakers through these trying times. Unsung war workers tho' they may be, their reward comes, as they say, in the countless comments received from women-friends, new and old, all over the country who seem to pretty much agree on the G-E Consumers Institute as a source of practical help in home-making . . . now more vital than ever. And from this same Institute, as in the past will come the ideas and designs for those wondrous new appliances for tomorrow's brighter, better world.

NEW VICTORY HOMES TOMORROW!

This ACCURATE METERING

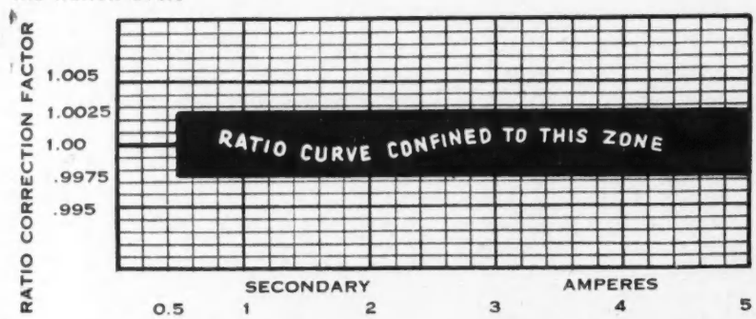
OF *high-voltage* SAVES COPPER, SAVES STEEL, SAVES SPACE . . .

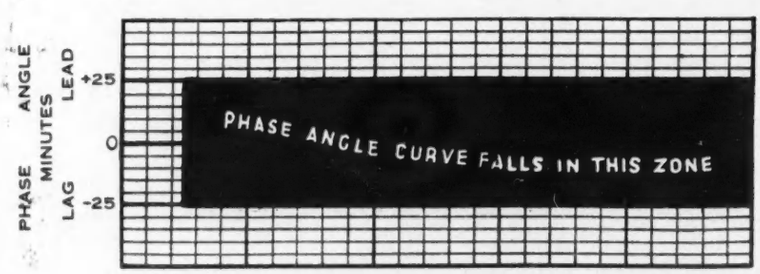
PACIFIC ELECTRIC

Bushing-Type • • Current Transformers

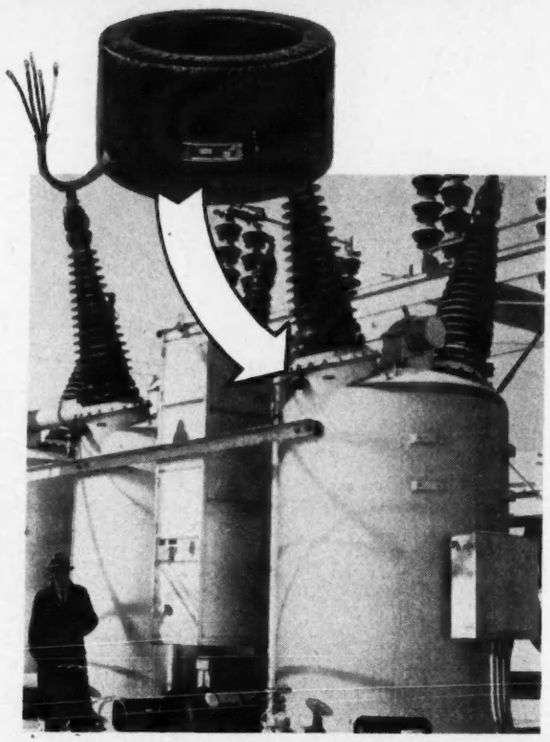
INSTALLED IN P. E. BREAKERS OF 115-kv. AND UP—TYPE CP—

Perfected for years by the Pacific Electric Mfg. Corporation, *here's why* these Bushing-Type Current Transformers are used by utilities the nation over.





CP Transformer Characteristics fall within limits of spaces above when connected to burden for which transformer compensated. Curves vary in shape depending upon KV and burden. For additional information see our Bulletin No. 57.



With more interconnected loads in vital defense areas, you need the *accurate metering* of our Bushing-Type Current Transformers. They are installed in P.E. Breakers, *old and new*, of 115-kv. and above. No separate oil, tank nor bushings needed. You also save copper, save steel, save space, save equipment. You save time and labor at installation.

They're safer, too—these CP Bushing-Type Current Transformers which meter accurately. Write for full details.

C. H. Cutter
1015 Securities Bldg.
Seattle, Wash.

U. N. Halliday
230 U. S. Nat'l. Bank Bldg.
Denver, Colo.

G. B. Kirkwood
437 S. Hill St.
Los Angeles, Calif.

Other Representatives in Principal Cities

Pacific Electric Mfg. Corporation

5815 THIRD ST., SAN FRANCISCO, CALIF. DUNES HIGHWAY, GARY, INDIANA

Horse Mesa Dam and Power Plant, where a new 60-cell Exide-Chloride Battery last year replaced another which had served for over sixteen years.

Exide CHLORIDE BATTERIES

Exides protect important generating and substations of

ARIZONA'S GREAT SALT RIVER PROJECT

THE SALT RIVER PROJECT embraces a series of five dams whereby the waters of the Salt and Verde Rivers have been impounded and regulated to assure year-'round irrigation and power to the inhabitants of the Salt River Valley. This fertile valley, approximately fifty miles long and twenty miles wide, is situated in the south central part of Arizona, where the rainfall averages only seven inches a year.

In the photograph above may be seen the Horse Mesa Dam and its 43,000 h.p. capacity generating station, while below is shown the Cross Cut Steam and Diesel Plant. In each of these, as in other stations of the system, a 60-cell Exide-Chloride Battery assures unfailing power for the operation of oil circuit breakers and for emergency lighting within the stations.

Executives in many types of plants are glad today that they selected Exide-Chloride Batteries. For aside from the dependable, trouble-free service to be obtained from these batteries is the knowledge that they will continue to render such service for years with the minimum of maintenance care.

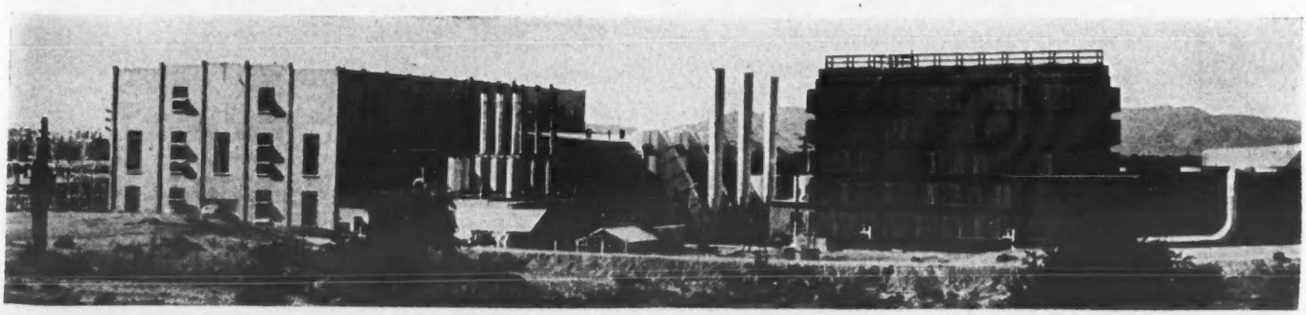
In these times it is especially desirable that you get all the life and service that is built into your Exide. Write us if you have a battery maintenance problem, or write for Bulletin No. 3225.

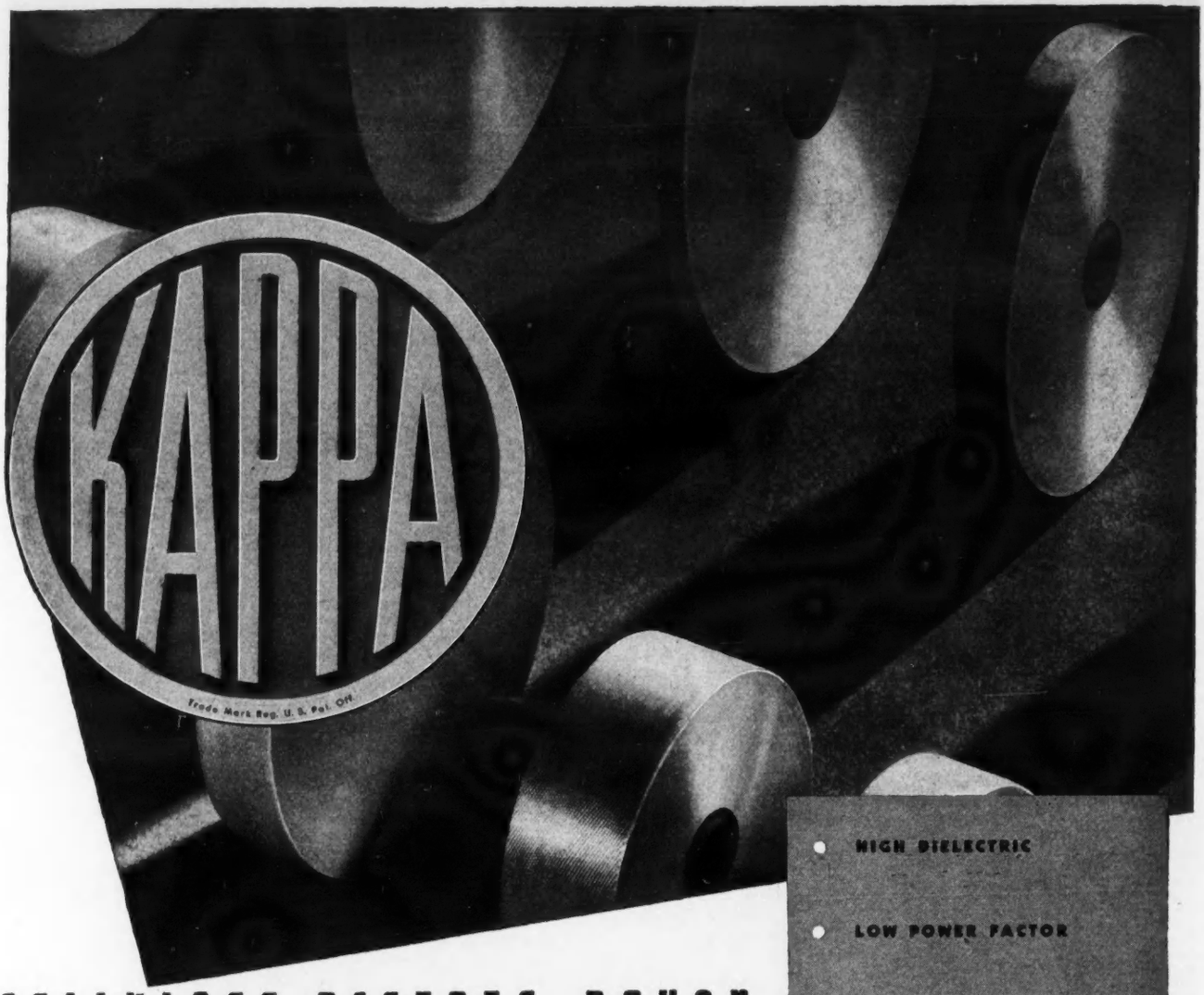
Cross Cut Steam and Diesel Plant which is also equipped with a 60-cell Exide-Chloride.

THE ELECTRIC STORAGE BATTERY CO., Philadelphia

The World's Largest Manufacturers of Storage Batteries for Every Purpose

Exide Batteries of Canada, Limited, Toronto





CELLULOSE-ACETATE RAYON

COIL WINDING TAPES

KAPPA TAPES, made of Cellulose-Acetate Rayon fabric (not an acetate film) have clearly demonstrated important superiorities over previously used coil winding materials both in unbiased laboratory tests and in actual production.

Dielectric breakdown tests, for example, have shown that, for a total thickness up to approximately 10 mils (fabric plus varnish), the breakdown voltage for varnished KAPPA TAPE may be 50% higher than for standard tapes tested, and that this is evidently due to the inherently high dielectric of the cellulose-acetate rayon fabric itself. Coupled with superior varnishing qualities, this has enabled coil manufacturers to attain equally high standards of insulation efficiency and quality of finish with fewer varnish dips.

Other proved KAPPA TAPE advantages are listed in the panel to the right ... advantages gained at no increase in cost over ordinary tapes and in a material that is immediately available. Detailed test data, prices and specifications are given in the new KAPPA TECHNICAL BULLETIN. We will be glad to send you a copy together with samples for your own tests. Write direct to Wm. E. Wright & Sons Company, Industrial Textile Division, Box 1000, West Warren, Mass.

- HIGH DIELECTRIC
- LOW POWER FACTOR
- ECONOMY IN VARNISHING
- LOW MOISTURE ABSORPTION
- FAST DRYING
- HIGH DRY TENSILE STRENGTH
- LOW COST

IMMEDIATELY AVAILABLE IN ANY QUANTITY
standard tape widths and mil thicknesses, also special widths

The Wright tape for every winding.. KAPPA

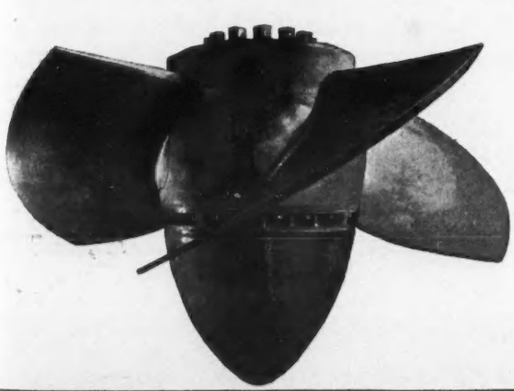
Look *to the* Future *when* You Buy Today

Two waterwheels, which delivered power to the mill for 60 years, were retired from regular service in 1938, although one is retained as a standby. In their place an S. Morgan Smith adjustable-blade hydraulic turbine was installed. This drives a G.E. generator and produces more power than the two old waterwheels combined.

LONG-RANGE PLANNING is particularly important in matters concerning Public Service. It means better-satisfied customers, fewer shut-downs for change-overs, increased production for any population growth, and an added protection to profits!

And refusal to compromise with quality will assure you of long-lived equipment, such as the clipping shows!

More than 64 years of pioneering, designing and engineering enable us to recommend equipment that will meet any need, exactly, whether it is for power plants for industrial concerns, or for public-service companies. And you can buy with confidence, because all designs are tested in our own Hydraulic Laboratory, and built in shops that are equipped with the most modern machinery known in the manufacture of water power equipment!

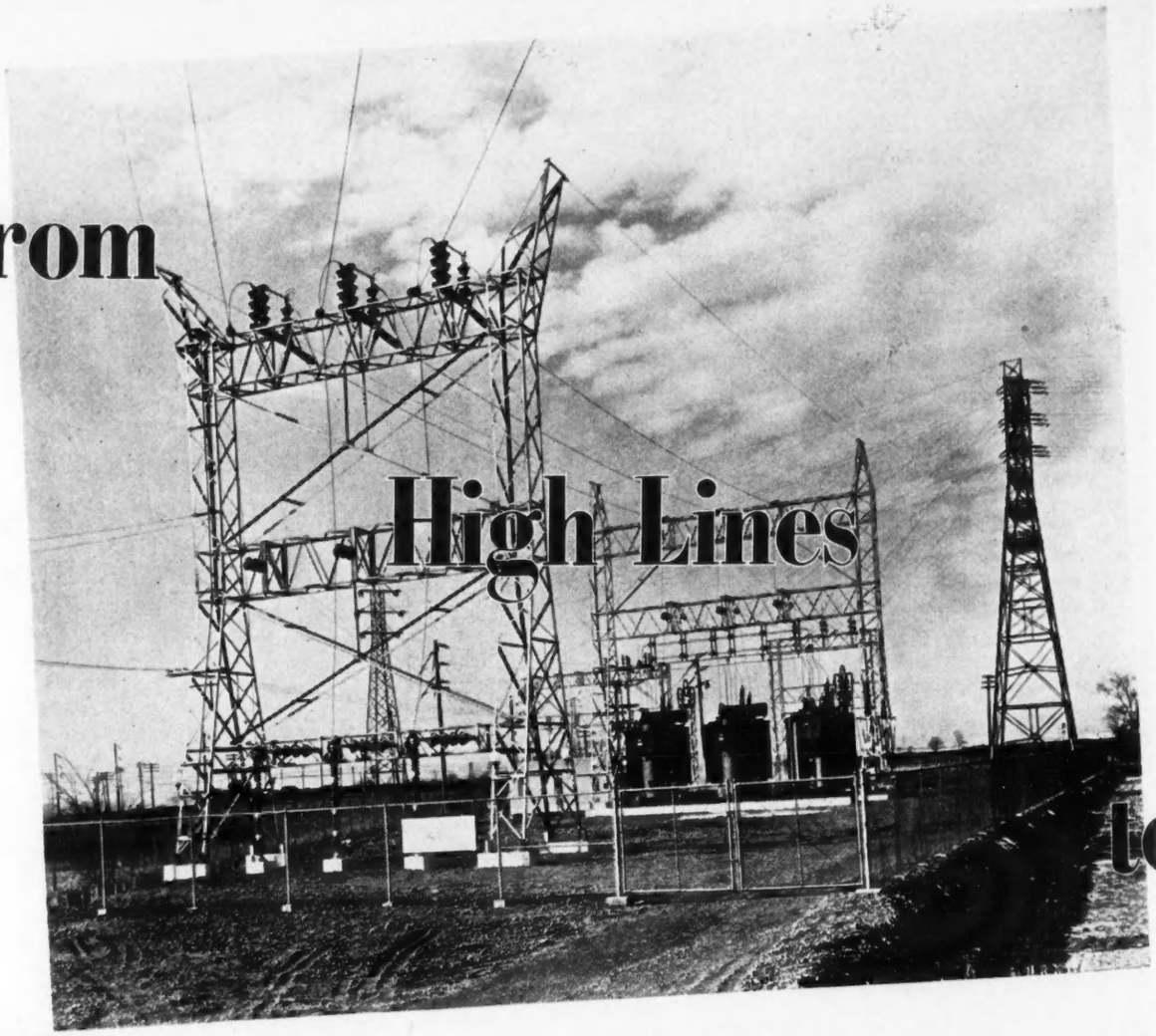


S·MORGAN SMITH COMPANY
YORK·PENNSYLVANIA~U·S·A·

If It's Hydraulics-Put It Up to Us·

POWER *by* SMITH

DELTA-STAR SERVES



Cable Supports for Open Wiring

HITCH YOUR WAGON TO DELTA-STAR

We address you not only for the present but also for the future when you will need equipment you cannot buy today.

DELTA-STAR is a nationally known, experienced organization with which you can well afford to keep in constant touch by reading its publications.

Just now, a very informative and useful pamphlet is No. 4210, entitled **Saving Copper—A War Time Necessity.** It tells how you can save time, copper and dollars, so essential today. If you would like a copy, just say the word.

For today and tomorrow, hitch your wagon to a star — DELTA-STAR.

DELTA-STAR ELECTRIC COMPANY

MAIN OFFICE AND FACTORY — 2400 Block, Fulton St., Chicago, Ill.
NEW YORK OFFICE — 140 Cedar St., New York, N. Y.

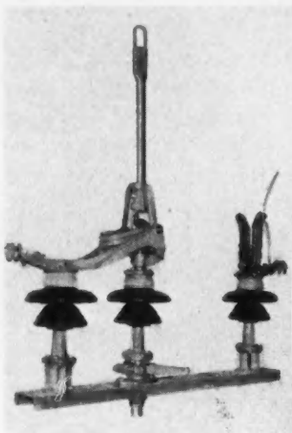
DISTRICT REPRESENTATIVES IN THE FOLLOWING CITIES

Birmingham, Ala.	Indianapolis, Ind.	Philadelphia, Pa.
Boston, Mass.	Kansas City, Mo.	Pittsburgh, Pa.
Buffalo, N. Y.	Knoxville, Tenn.	Richmond, Va.
Charlotte, N.C.	Los Angeles, Cal.	St. Louis, Mo.
Cleveland, Ohio	Minneapolis, Minn.	San Francisco, Cal.
Dallas, Texas	New Orleans, La.	Seattle, Wash.
Detroit, Mich.	Norfolk, Va.	Washington, D. C.
Denver, Colo.	Omaha, Neb.	Honolulu, Hawaii

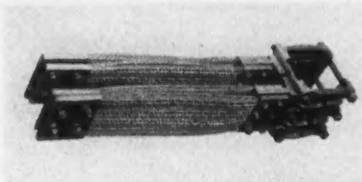
CANADIAN ASSOCIATE

Canadian Line Materials Limited.....Toronto 13, Canada

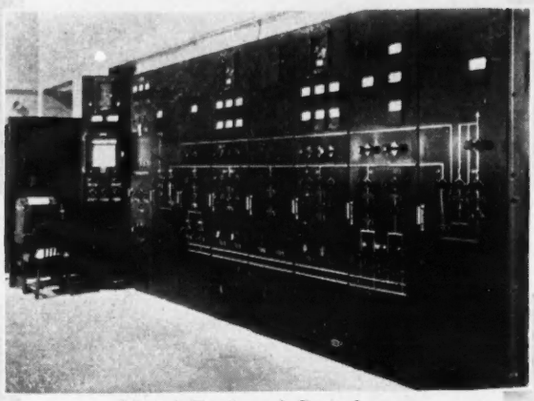
WAR INDUSTRIES—



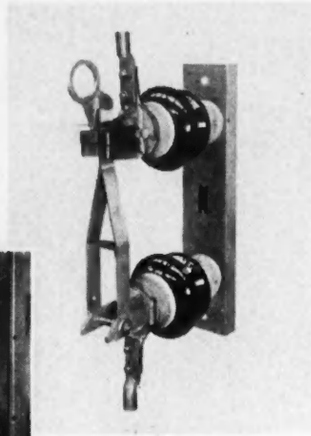
Group Operated Outdoor Switches



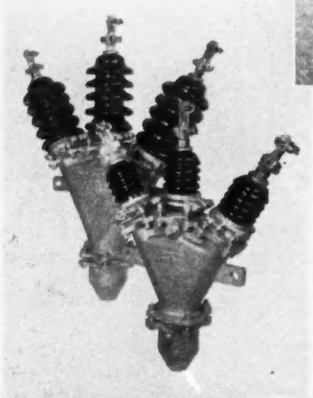
Flexible Expansion Connectors



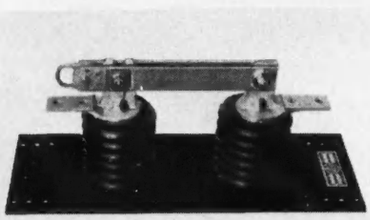
Metal Enclosed Switchgear



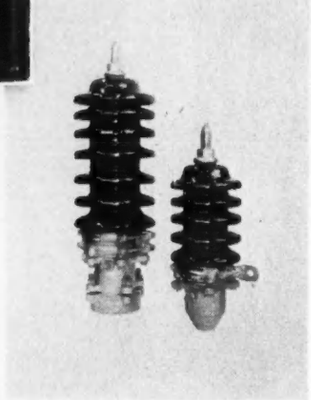
Hook Operated Outdoor Switches



Multiple Conductor Cable Terminators



Hook Operated Indoor Switches

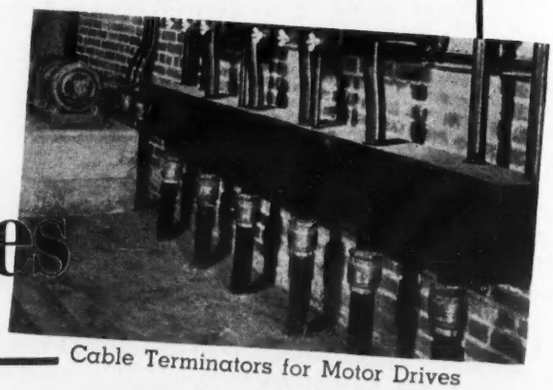


Single Conductor Cable Terminators

Production

Indoor and Outdoor Bus Supports

Lines



Cable Terminators for Motor Drives

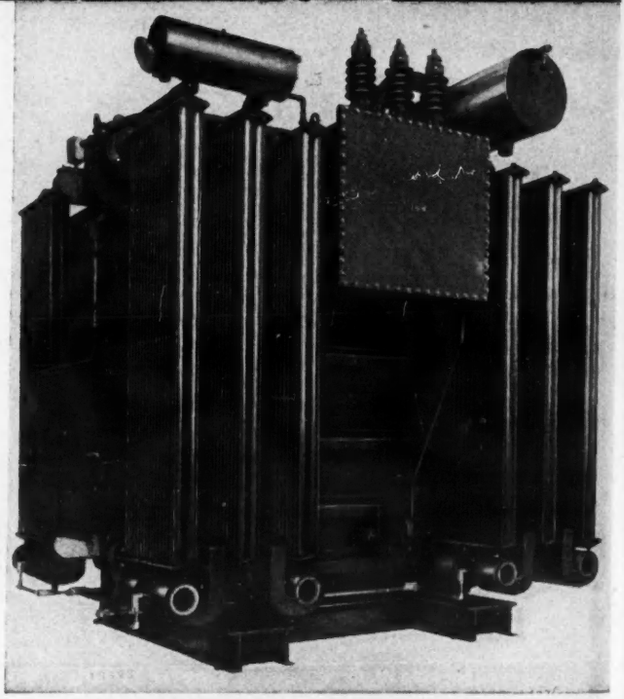
ASK FOR COMPLETE INFORMATION ON THESE DELTA-STAR "UNIT TYPE" PRODUCTS

Air Break Switches
Bus Supports—Indoor, Outdoor
Bus Fittings—All Types
Cable Saddles—Lead Cable
Cable Supports—Open Wiring
Cable Terminators
Clamps—Busbar & Ground
Connectors—Clamp & Solder
Control Switches
Crane Rail Supports
Disconnecting Switches
Fuse Mountings
Grounding Switches
Group Operated Switches
Metal-enclosed Switchgear
Motor Mechanisms
Outdoor Substations
Plugs & Receptacles
Rural Line Switches
Pipe Fittings—"Uniclamp"

MOLONEY TRANSFORMERS Provide Dependable Power

IN hospital operating rooms, skilled hands and trained eyes rely upon the assistance of electric power. Where continuity of electric service is of such vital importance, Moloney Transformers can be depended upon for unfailing operation.

These transformers are designed and fabricated in a plant whose entire effort is directed toward the manufacture of but one product . . . transformers. Specialization for over 40 years has resulted in the development of transformers which will provide service under the most severe operating conditions

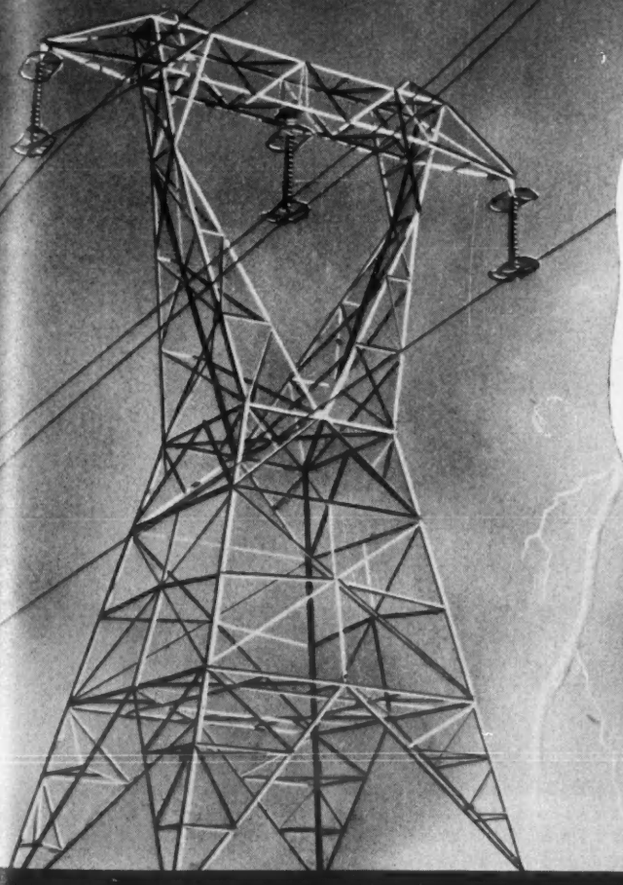


13,333 Kva, 3-Phase, 33,000 volts Primary to 4500Y volts Secondary, Moloney Power Transformer.

MOLONEY ELECTRIC COMPANY • ST. LOUIS, U. S. A.

TRANSFORMERS EXCLUSIVELY SINCE 1896

"Fair-Weather" Power Highways Won't Do



When power fails, production grinds to a stop. Important in the dependable delivery of power are the transmission towers that support the power lines. Not surprising, therefore, that operating engineers everywhere turn to Blaw-Knox transmission towers. Engineered into them is the satisfying certainty that they will not only make a good appearance during fair weather, but that they will withstand the stresses of storm, flood and frost. Because they are correctly designed, fabricated and galvanized, their maintenance cost is extremely low. A discussion is invited with regard to any power transmission problem.

BLAW-KNOX TRANSMISSION TOWERS

LAW-KNOX DIVISION OF BLAW-KNOX COMPANY 2013 FARMERS BANK BUILDING, PITTSBURGH, P
NEW YORK • CHICAGO • PHILADELPHIA • BIRMINGHA

"WE HAVE HAD ...NO NEEDLESS FUSE FAILURES on our 'Repulpers' SINCE WE INSTALLED BUSS FUSES Two Years Ago!"

Says CHIEF ELECTRICIAN JAMES P. COURNEENE, ESCANABA PAPER CO., ESCANABA, MICH.

"On a battery of 'repulpers', individually driven by 50 hp. 440 volt 3 phase motors, we formerly had, when using ordinary renewable fuses, an average of two shutdowns daily per motor. These shutdowns were due to fuse failures on the temporary harmless overloads common with this type of equipment.

"The consequent production loss involved was of considerable importance. About two years ago we equipped all these motors with BUSS Super-Lag fuses and in all that time there has not been a single fuse failure from harmless overloads.

"We have now standardized on BUSS Super-Lag fuses throughout the mill as this is only one of several instances where we have cured expensive shutdowns on similar circuits. We could hardly afford to use any other fuse."

MR. COURNEENE EXPLAINS

When Inexpensive Buss Fuses Give "Non-Shutdown" Protection, Why Bother With Costly Protective Devices That Are Not As Efficient?

Why spend extra money for costly mechanically operated devices—when you can get inexpensive fuses that hold circuits in operation for years without opening once?

Why be annoyed by useless shutdowns with ordinary fuses when BUSS construction reduces needless opening of fuses to a minimum?

The experience cited by Mr. Courneene simply proves once more that it is not necessary to suffer from useless shutdowns caused by needless opening of protective devices. It shows that once properly installed BUSS fuses can be forgotten.

They require no maintenance or periodic inspection. They don't open needlessly. If one opens, you can be sure some condition needs correction. When one opens it requires less than 45 seconds to renew it with an inexpensive link.

The experiences of thousands of plants throughout all industry have proven time and again that with BUSS Super-Lag fuses you can obtain trouble free protection at a lower overall cost than with ordinary fuses or mechanically operated devices.

Here Is Why BUSS Fuses Greatly Reduce or Entirely Prevent Needless Blows

The fuse case is designed to insure good contact on the link, even when the fuse is renewed by an inexperienced person—and it is so designed that vibration or heavy overloads or the constant heating and cooling of the fuse will not permit poor contact to develop. Thus, excessive heat which causes fuses to blow when they should not is prevented.

The fuse link used is the famous "BUSS SUPER-LAG." It has lag-plates attached to it. These give it a long time-lag so that unusually heavy starting currents or other harmless overloads will not cause the fuse to blow.

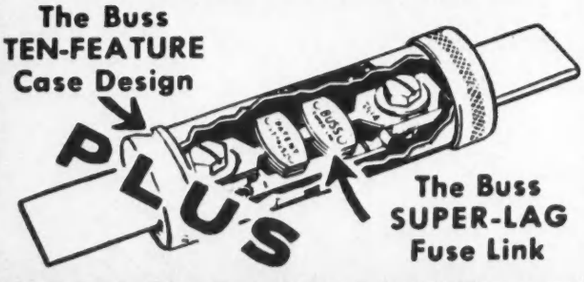
—And Here Is How To Solve The "Shutdown Problem" In Your Own Plant

Pass the word along that all purchase records dealing with circuit protective devices should be immediately changed to call for BUSS Super-Lag Renewable fuses. Then as fuses are replaced or new installations made, your plant will automatically get the benefit of the carefree, trouble proof protection that BUSS Super-Lag fuses give. BUSSMANN MFG. CO., University at Jefferson, St. Louis, Mo. Division McGraw Electric Company.

BUSS *Super-Lag* FUSES

WHY BUSS FUSES DON'T BLOW NEEDLESSLY

The Buss TEN-FEATURE Case Design



FIRING AWAY

More production is the order of the day. Men and machines work on, while guns, tanks, ships, planes, ammunition become the tools of war. This is a vital part of our Nation's program for Victory. It enables our armed forces to thunder their powerful message to the enemy on the world's fighting fronts. Behind this mighty task, providing boundless, unfailing energy for our industries, are Natural Gas and Electricity—master servants which perform their appointed wartime duties silently, effectively, continuously . .

★
1500

Yes, Columbia System is enlisted for the duration. Already 1500 of its employees have relinquished varied peacetime duties to join the colors.

COLUMBIA GAS & ELECTRIC
CORPORATION

With all hearts in the war— how can R&IE advertising serve you best ?
By giving you straight, time saving, consistent, working data on R&IE products, and making it easy for you to CHECK THE FACTS. Consistent with War Production efficiency, this program is streamlined to bare essentials for immediate or future use.
PRODUCTION
COMPLETE SUBSTATION
OPERATING MECHANISMS
DISCONNECTING SWITCHES
AIR BREAK SWITCHES
CONNECTORS
BUS CLAMPS
CUTOUTS
THERMO-RUPTERS
METAL HOUSED, ISOLATED BUS
TESTING FACILITIES
AUTOMATIC THROW-OVER EQUIPMENT
METAL CUBICLE
turn the page

RAILWAY AND INDUSTRIAL ENGINEERING CO.

ENGINEERING AND PRODUCTION

COMPLETE SUBSTATION

OPERATING MECHANISMS

DISCONNECTING SWITCHES

IR BREAK SWITCHES

CONNECTORS

BUS CLAMPS

CUTOUTS

THERMO-RUPTERS

METAL HOUSED ISOLATED BUS

TESTING FACILITIES

AUTOMATIC THROW-OVER EQUIPMENT

METAL CUBICLES

INTER...

TESTING DEVICES

AND YOU CAN QUICKLY
CHECK THE FACTS on R&IE PRODUCTS
EVERY TIME YOU SEE AN R&IE AD.

RAILWAY AND INDUSTRIAL ENGINEERING COMPANY • GREENSBURG, PA.
IN CANADA—EASTERN POWER DEVICES, LTD., TORONTO

Now Is the Time to Measure the Cooking Load

Wartime presents an opportunity to evaluate different types of loads

ASTUTE public utility men, neck-deep in providing loads for war production, are studying these loads more carefully than ever. This war has thrown new light on the great value of commercial electric cooking. Meter tests in army barracks show conclusively that cooking is an off-peak load which falls in the "valleys" of basic lighting load. Approximately one-half of the cooking requirements are absorbed in the off-peak periods of the lighting load.

Low demand factors, high load factors and excellent diversity accompany the use of electric cooking.

Comes the end of the war there will be real cause to distribute for civilian use the vast energy built up to supply America's war machine. Commercial electric cooking is an important solution. Thousands of chefs, cooks and bakers, now in the armed forces, are learning the dependability, safety and simplicity of Hotpoint-Edison Electric Cooking. When they return to their jobs in hotels, restaurants, bakeries and institutions the demand for electric cooking will be greater than ever.

Now is the time to evaluate different types of loads. Learn how profitable is the electric cooking load. Get ready for the big surge of business which will be a logical aftermath of war. Edison General Electric Appliance Co., Inc., 5618 West Taylor Street, Chicago, Ill.

★ ★ ★ ★ ★ ★ ★

PREPARING FOR THE FUTURE

Hotpoint-Edison realizes the great future of electric cooking. During the war our advertising to hotels, restaurants, bakeries, hospitals and institutions continues to tell the great story of electric cooking. This advertising is designed to prepare for the day when you and we turn from war to peace.

FOUND ONLY IN MODERN KITCHENS

Hotpoint EDISON

COMMERCIAL ELECTRIC COOKING EQUIPMENT

BOSTON NEW YORK CITY ATLANTA CLEVELAND CHICAGO KANSAS CITY
DALLAS LOS ANGELES SEATTLE SALT LAKE CITY

CANADA—Canadian General Electric Company, Ltd., Toronto

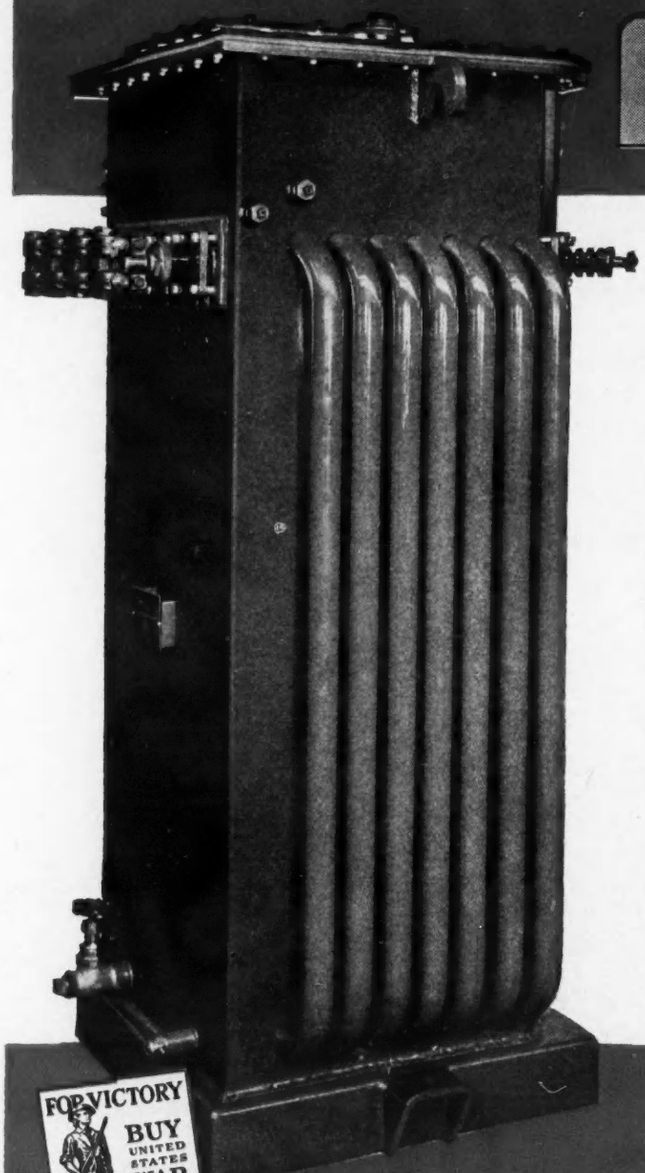
OLDEST AND LARGEST MAKER OF ELECTRIC COOKING EQUIPMENT

WAGNER

NOFLAMOL TRANSFORMERS

(NON-INFLAMMABLE LIQUID-FILLED)

Give you a combination of advantages worth investigating



★ **INDOOR INSTALLATION WITHOUT VAULT**

Noflamol transformers may be installed indoors without the use of expensive fireproof vaults since the liquid used in the transformers is non-inflammable. Considerable installation expense is thereby avoided.

★ **IMPROVED PLANT EFFICIENCY . . .**

Savings are effected by dividing the circuit into several sections and placing a Wagner Noflamol transformer at the load-center of each, eliminating long runs of secondary copper, reducing line losses, and improving voltage regulations. Plant efficiency is thereby improved.

★ **NO SPECIAL FOUNDATIONS . . .**

The only foundation necessary for installation of Wagner Noflamol transformers is a level floor, strong enough to support their weight.

★ **SAVES VALUABLE FLOOR SPACE . . .**

Wagner Noflamol transformers may be installed in out-of-the-way places, thereby releasing valuable floor space for production. Since no vault is needed, less space is necessary for a Noflamol transformer installation.

★ **SAVES MAINTENANCE EXPENSE . . .**

The liquid used in Noflamol transformers is chemically stable, has high dielectric strength, and will not sludge.

Bulletin TU-33 describing Wagner Noflamol transformers will be mailed on request.

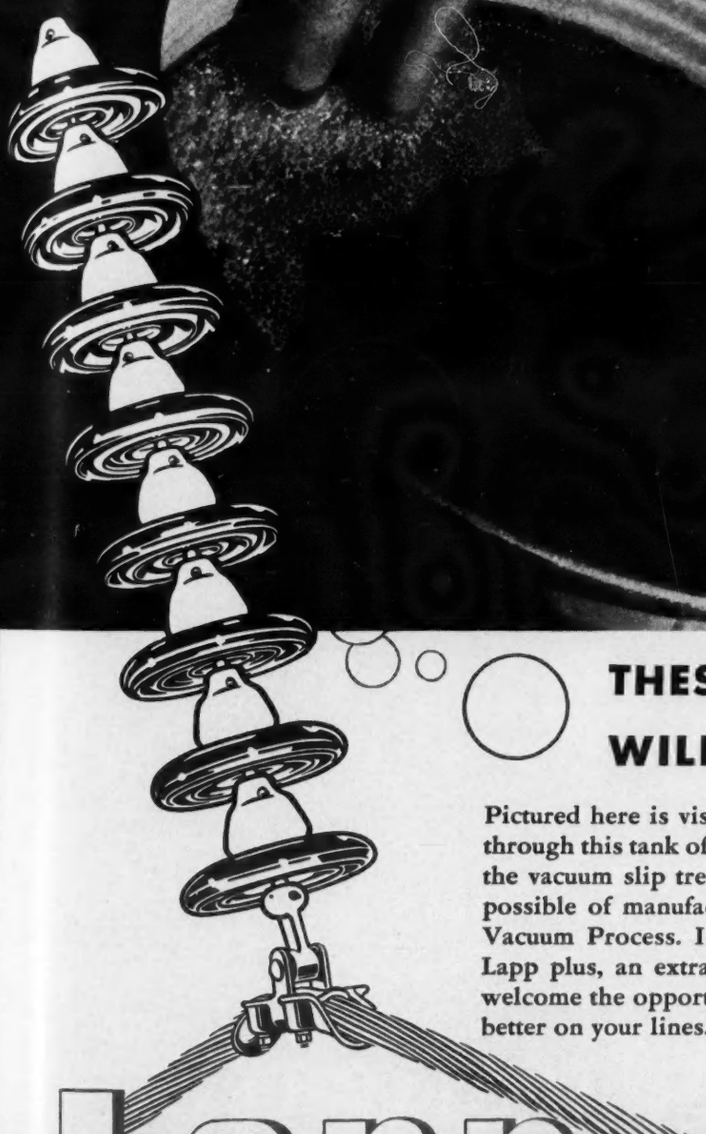
T43-1

Wagner Electric Corporation

6400 Plymouth Avenue, Saint Louis, Mo., U.S.A.

TRANSFORMERS • MOTORS • BRIDGE BRAKES

IT'S THE *PORCELAIN* THAT INSULATES

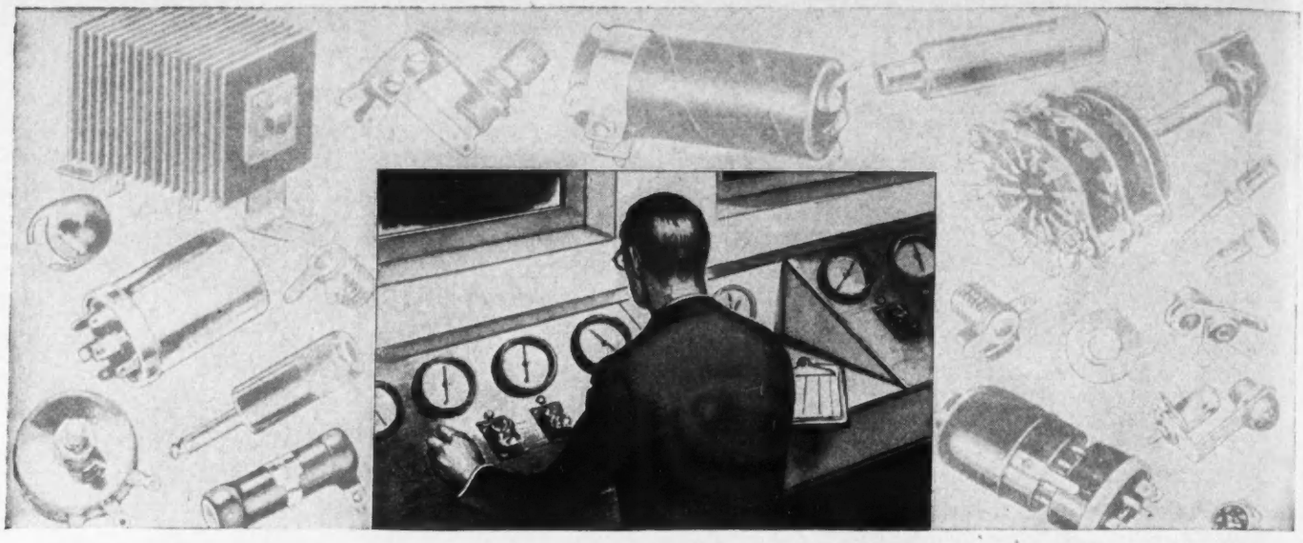


THESE AIR BUBBLES WILL NEVER SPOIL AN INSULATOR

Pictured here is visible evidence that Lapp Vacuum Process does its job. Bubbling through this tank of water is the air expelled from the liquid clay, as it passes through the vacuum slip treatment. Many of the porcelains in routine Lapp production are possible of manufacture only because of the superior quality of clay produced by Vacuum Process. In conventional types of insulators this superior porcelain is a Lapp plus, an extra factor guaranteeing mechanical and electrical integrity. We'll welcome the opportunity to tell you just why we think Lapp Insulators will perform better on your lines. Lapp Insulator Co., Inc., Le Roy, N. Y.

Lapp

Better Porcelain • Better Insulators



Probably Your Mallory Distributor Can Give You Help Like This—

Somewhere in the Middle West is an aircraft engine manufacturer who uses many Mallory Electronic parts in dynamometer test cells. Recently he sent us a hurry call for some Mallory phone jacks to go in the control panel of a new cell being rushed to completion. He had the right priority, too.

It was a standard jack, but as is so often the case with manufacturers immersed in war production, it was out of stock. To produce it, we would have had to start from scratch—"when, as and if!"

But we referred his request to the local Mallory distributor —who filled his needs from stock.

This is just a sample of how Mallory distributors can help. We do our level best to furnish them with adequate stocks so that essential electronic parts to fill small orders with high priorities may be handled promptly.

It will pay you to maintain a contact with your local Mallory distributor. He will give good service, furnish your purchasing department with complete information and prices; your engineering and design departments with application data; work his head off to get you those parts you need for maintenance, test equipment and pre-production models.

P. R. MALLORY & CO., Inc., INDIANAPOLIS, INDIANA

Cable Address—PELMALLO

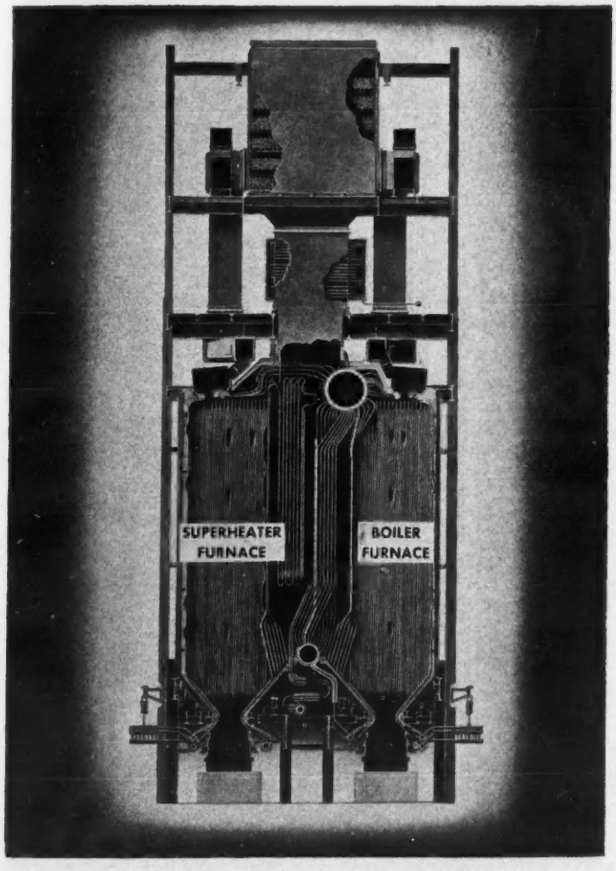
Get acquainted with your local Mallory distributor. Or if you do not know who he is, write us and we will put him in touch with you. And, for good measure, we will send along a copy of the Mallory Catalog for ready reference.

P. R. MALLORY & CO. Inc.
MALLORY
APPROVED
PRECISION PRODUCTS

OPERATING ADVANTAGES OF TWIN FURNACES

1. WIDEST RANGE OF SUPERHEAT CONTROL
2. SLAG FREE OPERATION
3. OVERHEATING OF SUPERHEATER ELIMINATED
4. HIGH AVAILABILITY
5. LOW DRAFT LOSS
6. HIGH RATE OF CIRCULATION

→ because BOILER and SUPERHEATER OPERATE IN PARALLEL and NOT IN SERIES.



Draft loss constitutes an important economic factor that is often underestimated. For instance, a recent study which covered an installation of six boilers, each of 550,000 steam capacity, revealed that the capitalized power cost for one inch of draft loss amounted to $75,000.

The Twin Furnace unit with these inherent design characteristics assures this all important low draft loss:

1. Gas flows through boiler and superheater in parallel and not in series—thus maximum draft loss is that of the flow through either boiler or superheater and not the sum of the two as found in conventional boiler arrangements.
2. Single flow without turns through tube banks.
3. Short and straight flue convections to economizer and air heater.

The Army-Navy Production "E" has been awarded to Foster Wheeler in recognition of quality equipment, in quantity, on time.

FOSTER WHEELER CORPORATION

165 Broadway, New York, N. Y.

FOSTER WHEELER

TIME HAS PROVEN
S&C SILVER
SILVER ELEMENT
S AND C
SILVER

VEN THE MERITS OF VER FUSE ELEMENTS

THE SAME ENGINEERING,—the same care in manufacturing,—the same dependable performance you have found through actual use in S & C Power Fuses are incorporated in S & C Universal Fuse Links for distribution cutout service. The fusible elements in both are Silver,—proven far superior by many years of use.

The accuracy of the silver elements as used in all S & C Power and Distribution Fuses has been demonstrated. The surge capacity, which enables them to withstand repeated momentary overloads without seriously damaging the fusible element or causing unnecessary service interruptions, is reflected in many an operating record.

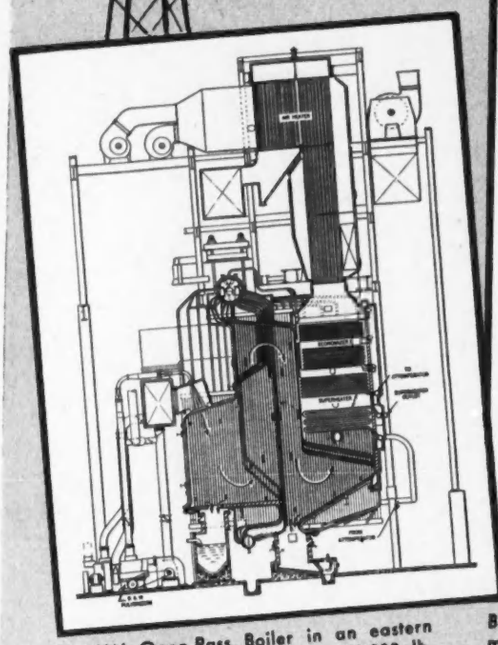
During many years of service, S & C Silver Fuse Elements have proven their resistance to corrosion and deterioration, thus preserving their high, initial accuracy in time current characteristics.

This accuracy, so important to the proper protection of power systems is built into All S & C Fuses, making them first choice of discriminating engineers, especially for selective operation.

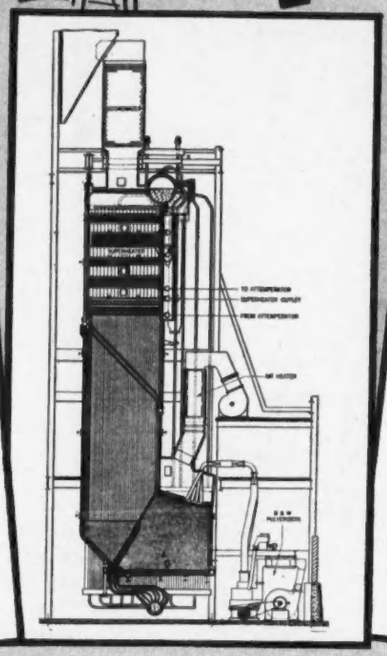
SCHWEITZER & CONRAD, Inc.
4435 Ravenswood Avenue **Chicago, Ill.**
Manufactured in Canada by Powerlite Devices, Ltd., Toronto, Ont.

R ELEMENT FUSES

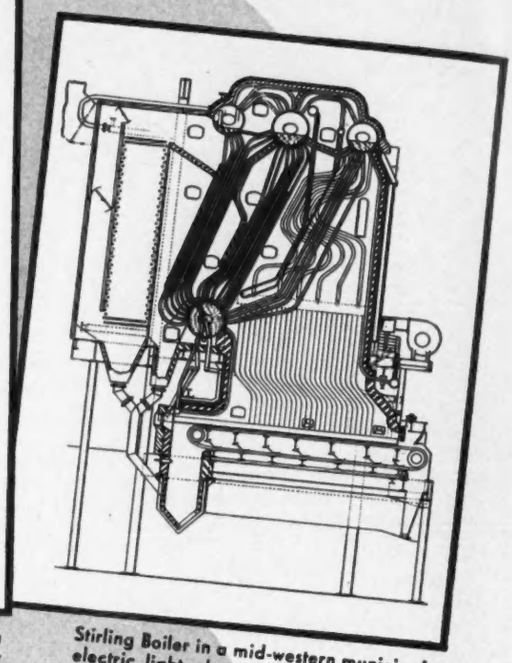
Helping



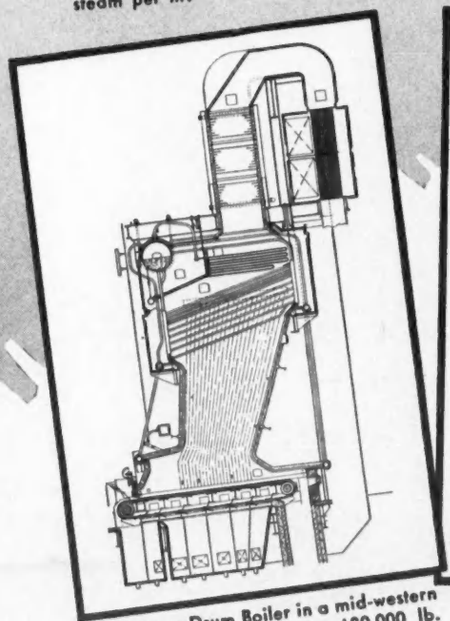
B&W Open-Pass Boiler in an eastern central station — Capacity 350,000 lb. steam per hr.



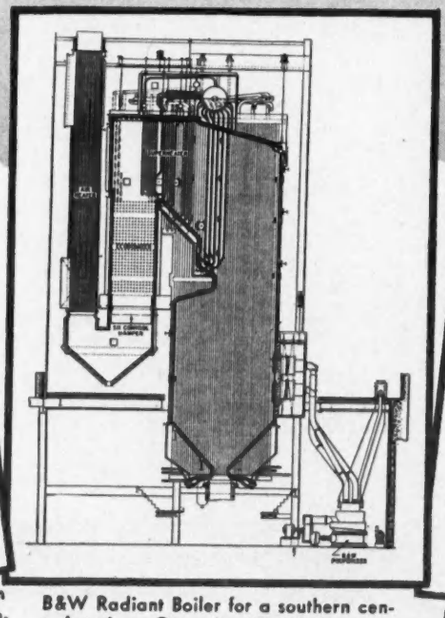
B&W High-Head Boiler in a mid-western municipal electric light plant—Capacity 300,000 lb. steam per hr.



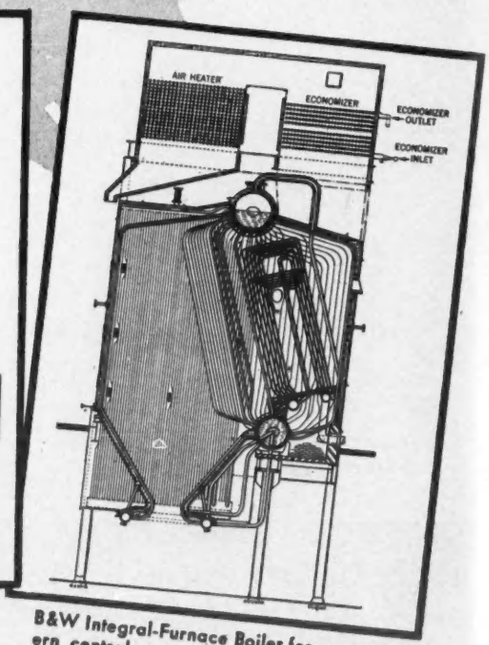
Stirling Boiler in a mid-western municipal electric light plant — Capacity 125,000 lb. steam per hr.



B&W Cross-Drum Boiler in a mid-western central station — Capacity 180,000 lb. steam per hr.

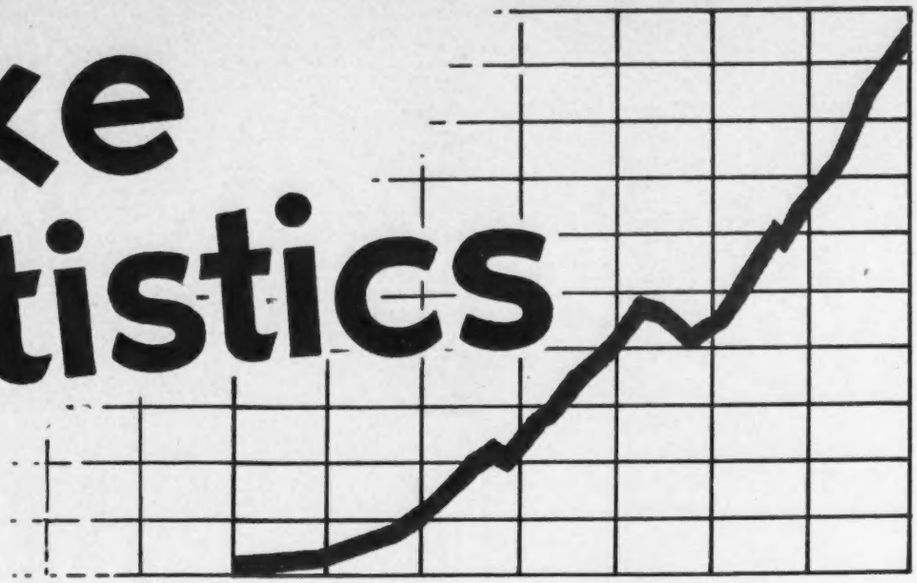


B&W Radiant Boiler for a southern central station—Capacity 400,000 lb. steam per hr.



B&W Integral-Furnace Boiler for an eastern central station — Capacity 150,000 lb. steam per hr.

Make Statistics



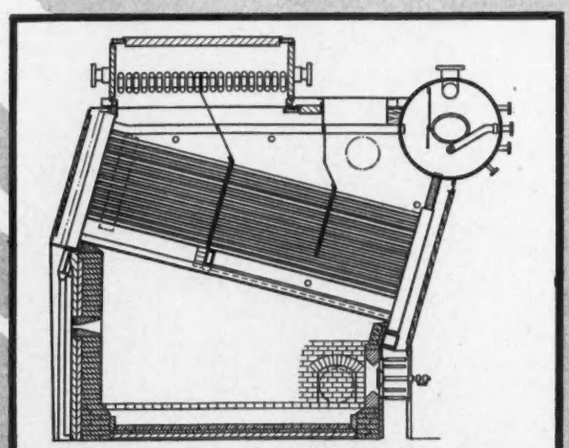
Statistical peaks in war-time power production have been made possible in no small degree by boilers built by B&W. The Open-Pass, Radiant, High-Head, and Integral-Furnace Boilers, the more recent of B&W's designs, have definitely established their ability to supply large blocks of power reliably. Standard B&W Cross-Drum and Stirling boilers need only passing mention as statistics makers—they have made records in their fields for many decades.

Noteworthy as is the production of steam for industrial power by B&W boilers, the records made in the marine field by other B&W boilers are equally impressive—whether in naval or other government service, or in the merchant marine. Statistics of ships placed in service might well be interpreted in terms of additional B&W boilers gone to sea, since B&W builds the greatest proportion of marine boilers. And one of B&W's designs was chosen by the Maritime Commission for all of its Liberty Ships, and all manufacturers of Liberty Ship boilers are working to B&W drawings.

So, whenever statistics on steam-power production appear, in the background are B&W boilers helping make the statistics possible. And, after the war, when materials for boilers for general service are again freely obtainable, B&W boilers with inherent richer experience will be available.

G-241T

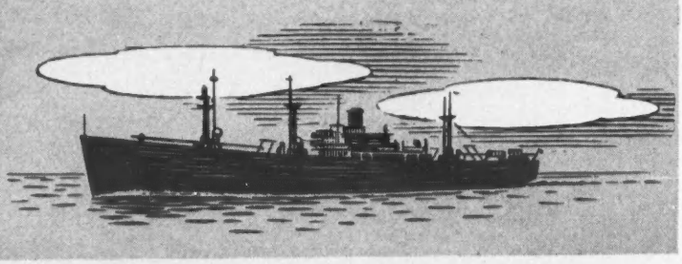
The Maritime Victory flag and "M" burgee now float proudly alongside the Navy "E" at the Barberton Works. Each is an award for "outstanding achievement" and is "an honor not lightly bestowed".

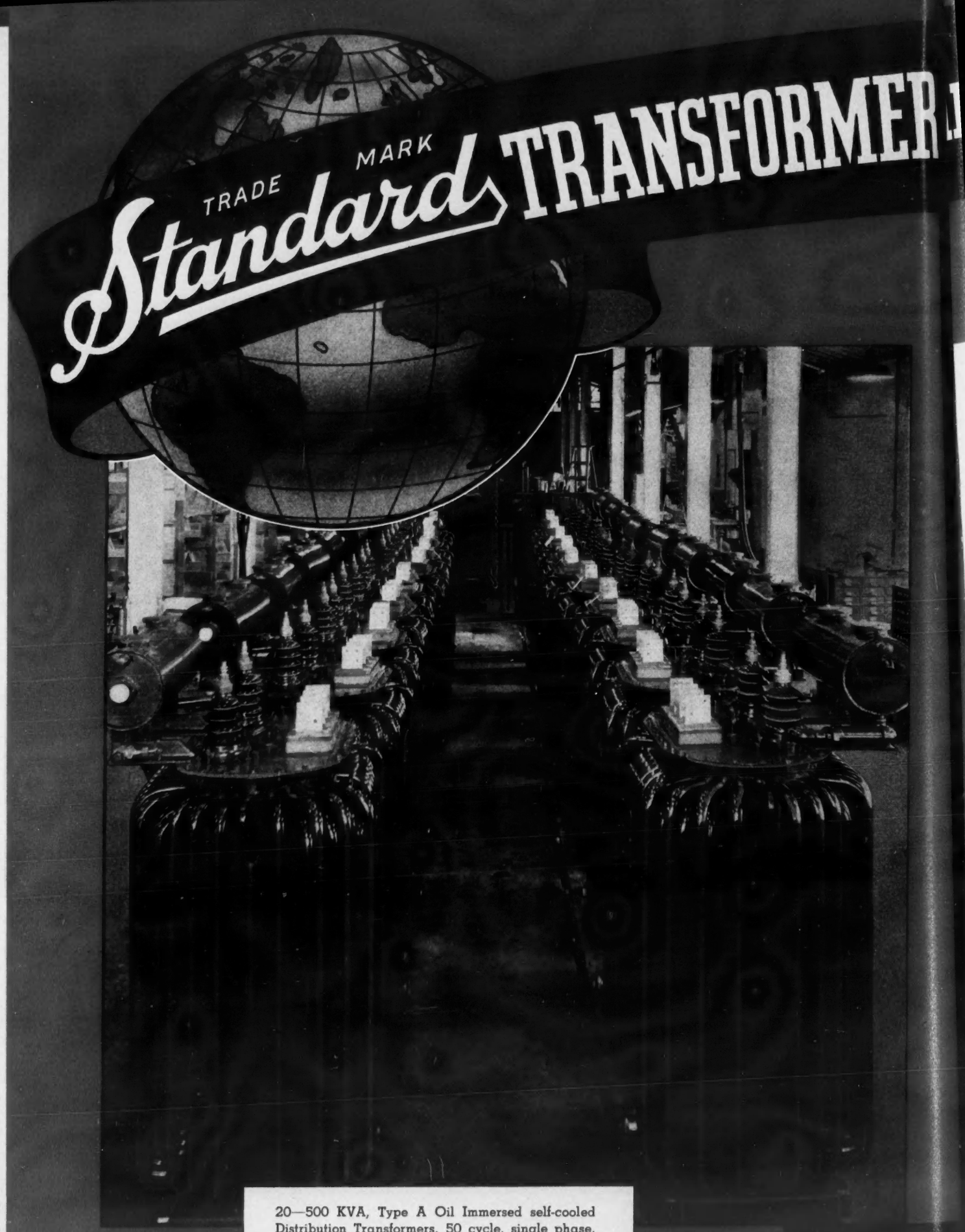


Sectional side elevation of the Liberty ship boiler

BABCOCK & WILCOX COMPANY

85 LIBERTY STREET, NEW YORK, N. Y.





20—500 KVA, Type A Oil Immersed self-cooled Distribution Transformers, 50 cycle, single phase, 11,000 V primary, with four 5% taps below normal, to 230/460/400Y V secondary; 45 deg. C rise.

THE

Rn Service Around the Globe

To meet the rapidly expanding power needs of our armed services Standard Power Transformers are being shipped to all corners of the earth. Today Standard Transformers are on 24-hour service in Naval Stations, in Army Camps, in Troop Concentration Camps around the Globe.

Designed for a specific service—developed to save critical materials and built by an experienced organization, Standard Transformers are meeting the unusual power demands of a Nation at War.

The in-built quality of Standard Transformers, so essential to War time operations, will continue to serve your power transmission lines for the duration and for many years to come.

For quick action, consult a Standard Representative on your transformer needs.

Recently increased engineering facilities are illustrated at right. This group of Engineers is thoroughly familiar with all transformer-design and engineering problems encountered in today's production drive. Their services are available to help you solve your problems.

STANDARD TRANSFORMER CO.
WARREN, OHIO, U. S. A.

SABOTAGE ... *from the air*

Sharp . . . jagged . . . destructive! Not bombs. Merely little specks of dust . . . but far from harmless, as high-powered microscopes would show.

It is easy to imagine what damage these hard, jagged particles can do to precision finished bearing surfaces in equipment ranging from delicate instruments to heavy machines. When a highly finished part must be scrapped because of dust-damage, much more is lost than just a piece of metal. Many hours of expensive, painstaking labor are completely wasted.

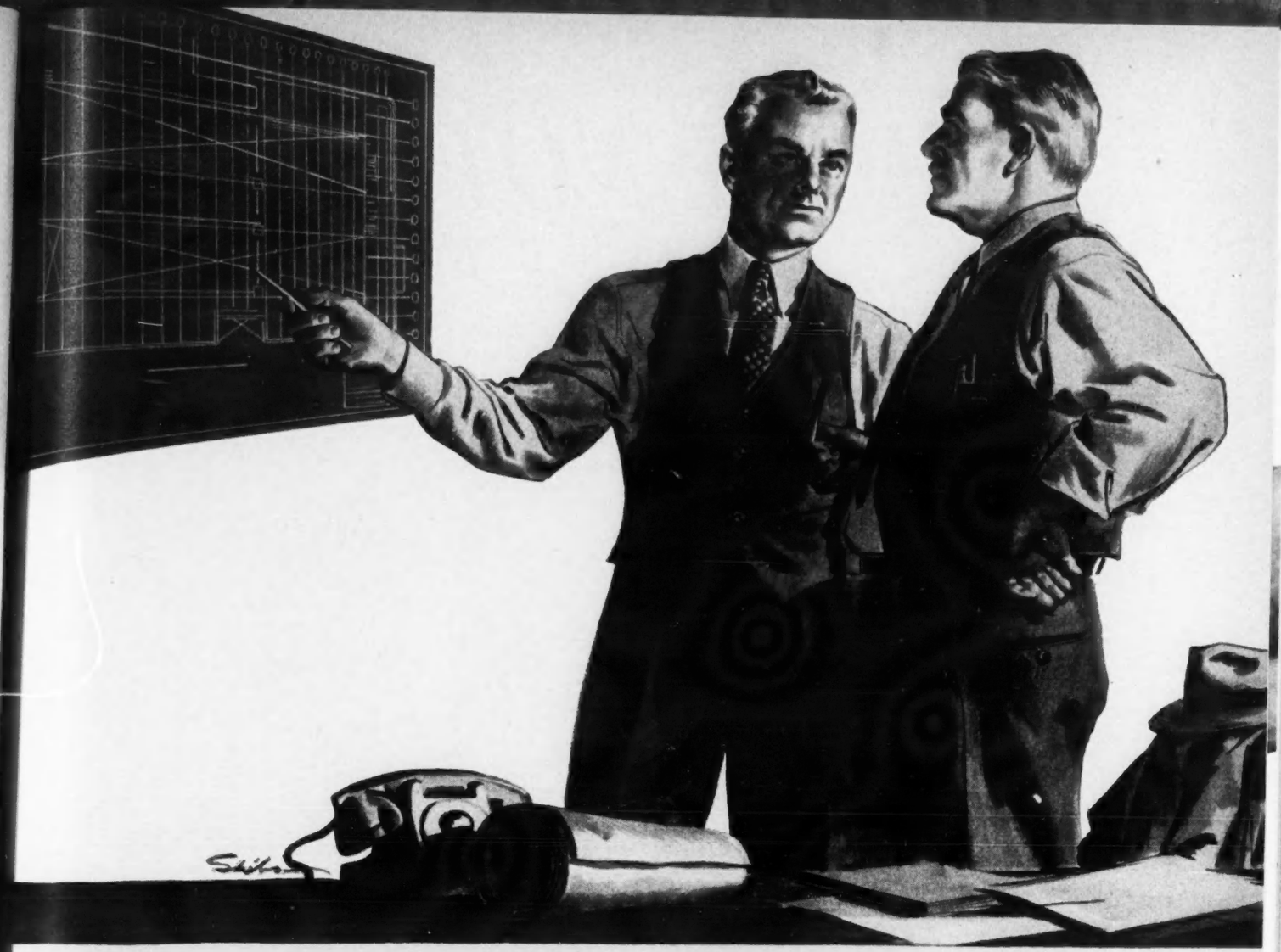
One of the best defenses against dust-sabotage is air conditioning . . . the specially designed kind of air conditioning which, through efficient air filtering and accurate control of temperature and humidity, is making possible precision tolerances never before attainable.

General Electric has taken an outstanding part in the development of this new air conditioning. Already, the war has taught us how to make equipment more compact, more flexible, and far more efficient. Required "climates" are faithfully reproduced. When the war is over, air conditioning... better, cheaper, more universally used... will do much to make the world of the future happier and more useful for everyone. Then, as now—General Electric will be a leading source of all kinds of air conditioning.

Air Conditioning and Commercial Refrigeration Department, Division 431, General Electric Co., Bloomfield, N. J.

Air Conditioning by

GENERAL ELECTRIC



Have you ever teamed up with a Square D Field Engineer?

Conversion, expansion, and 24-hours-a-day operation have brought a lot of "tough nuts to crack" in every phase of production—and electricity is no exception. You'll find a Square D Field Engineer a source of sound counsel whenever you are confronted with problems of electrical control or distribution. He can help you simplify new jobs, and do old ones better. And backing him up in every Square D plant, are design and engineering specialists with complete research and testing laboratories at their command.

There are Field Engineers in Square D branch offices in 52 principal United States and Canadian cities. Their services are dedicated to solving industry's war and post-war electrical problems.

Wherever Electricity is Controlled or Distributed

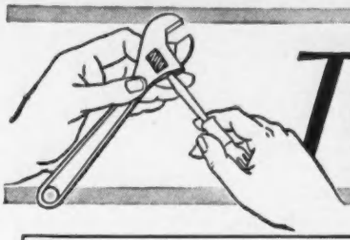
SAFETY SWITCHES ★ CIRCUIT BREAKERS ★ MOTOR CONTROL ★ SWITCHBOARDS ★ SQUARE DUCT ★ PRESSURE SWITCHES ★ PANELBOARDS ★ MULTI-BREAKERS ★ WELDING CONTROL MILITARY ★ AIRCRAFT ★ MARINE ELECTRICAL CONTROL

SQUARE D COMPANY

DETROIT - MILWAUKEE - LOS ANGELES

KOLLSMAN INSTRUMENT DIVISION, ELMHURST, NEW YORK

IN CANADA: SQUARE D COMPANY CANADA LIMITED, TORONTO, ONTARIO



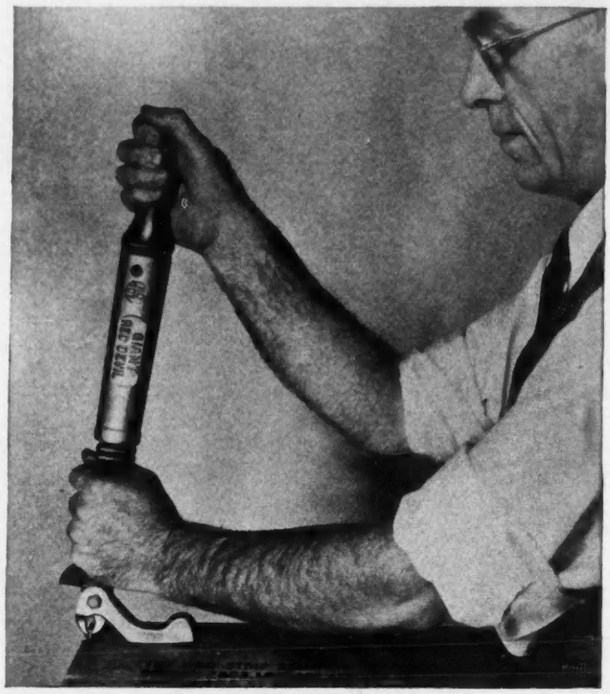
TOOL NOTES

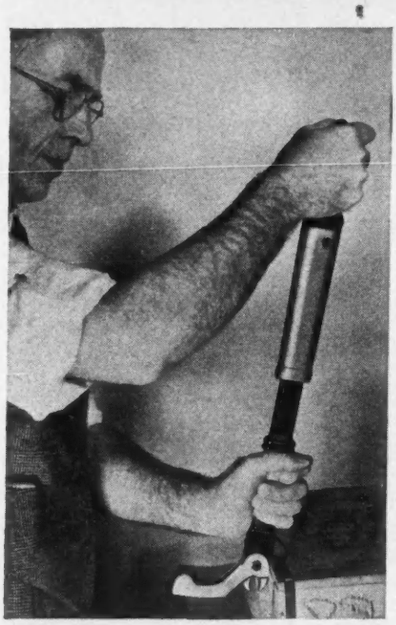
Maintenance and Repair Suggestions to Prolong Tool Life

No. 8 HOW TO USE CRESCENT NAIL PULLERS

While Nail Pullers are simple tools a few tips on their proper use may be timely, considering their increased use due to accelerated industrial activity.

● Once an operator gets the "knack" of handling a Nail Puller, surprising speed is attained. The two motions involved in withdrawing a nail blend into one continuous action with a little practice. The first step is illustrated below. With Puller held at the angle shown and jaws positioned so as to just straddle the nail head, drive the Rammer down with sufficient force to embed the jaws for a grip below the nail head. Now pull the handle toward you. The first movement closes the jaws to grip the nail and then lifts the nail out with a prying action as seen in the second illustration above and opposite. There should be no pause between the first and second operations once the operator becomes proficient. Nail Pullers work best with the width of the jaw blades *across* rather than with the grain of the wood.





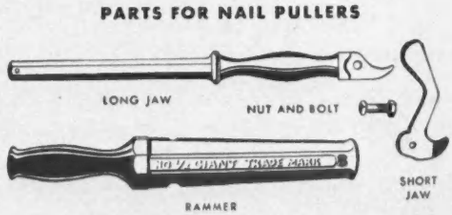
Crescent's Giant Red Devil Puller, No. 101, is equipped with a strap cutter for cutting the metal strapping frequently used on packing cases. The illustration at left shows the proper method of use. This cutter is not intended for cutting wire, nor are any Crescent Nail Pullers designed for pulling spikes.

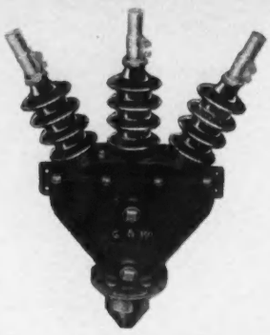
Repair Parts are available for Crescent Nail Pullers. Order by name of part and number of tool. (see below).

CRESCENT TOOLS
Give Wings to Work

CRESCENT TOOL COMPANY, JAMESTOWN, N. Y.

PARTS FOR NAIL PULLERS





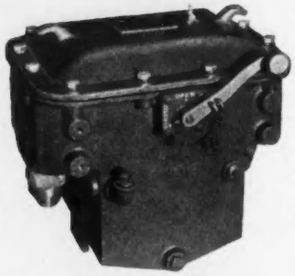
AMERICA'S POWER LINES

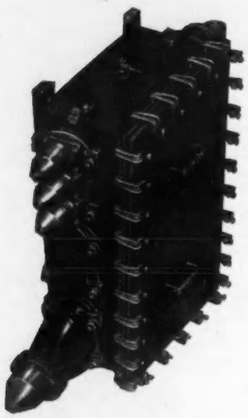
—THE NERVES OF AMERICA'S MIGHT!

Through a vast network, inconceivable in magnitude, power hums to millions of tools and machines. Tools that ask no rest. Power that hums without ceasing—hums a hymn of doom for tyranny.

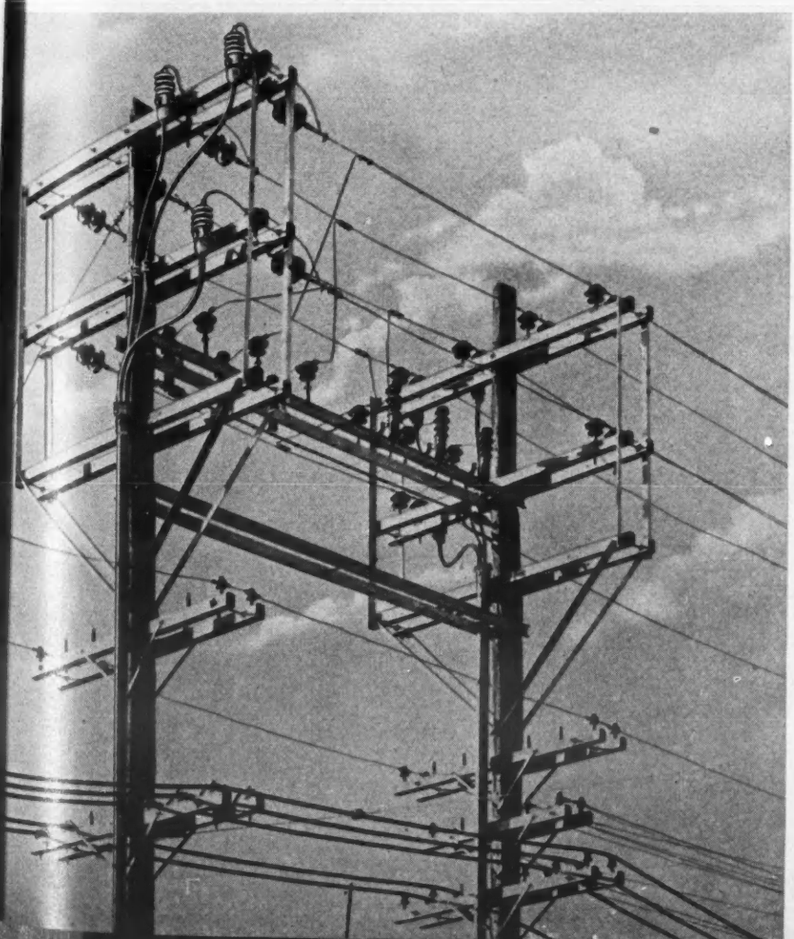
Throughout America's electric systems are G & W Products—Potheads, Boxes, Oil Switches, Oil Fuse Cutouts and other cable devices. You find them posted at vital points, quiet inconspicuous sentinels of efficiency obeying orders dependably—good soldiers.

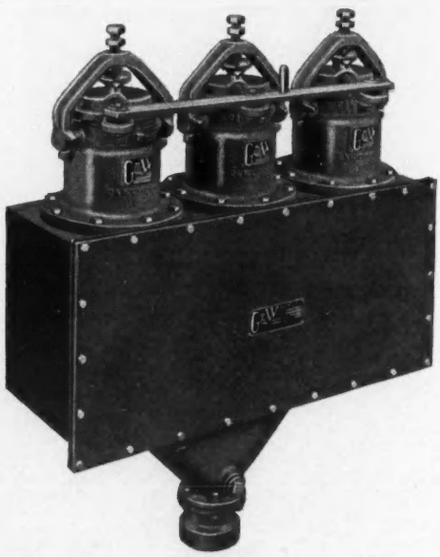
Experienced engineers and maintenance executives know G & W of old—as a name symbolic of quality and thoroughness; a name standing for sturdy performance that eliminates dangerous interruptions; a name rightly identified with the nerve system of America's military might.





G & W ELECTRIC SPECIALTY CO., 7780 DANTE AVE., CHICAGO, ILL.
In Canada • • POWERLITE DEVICES, LTD., TORONTO and MONTREAL

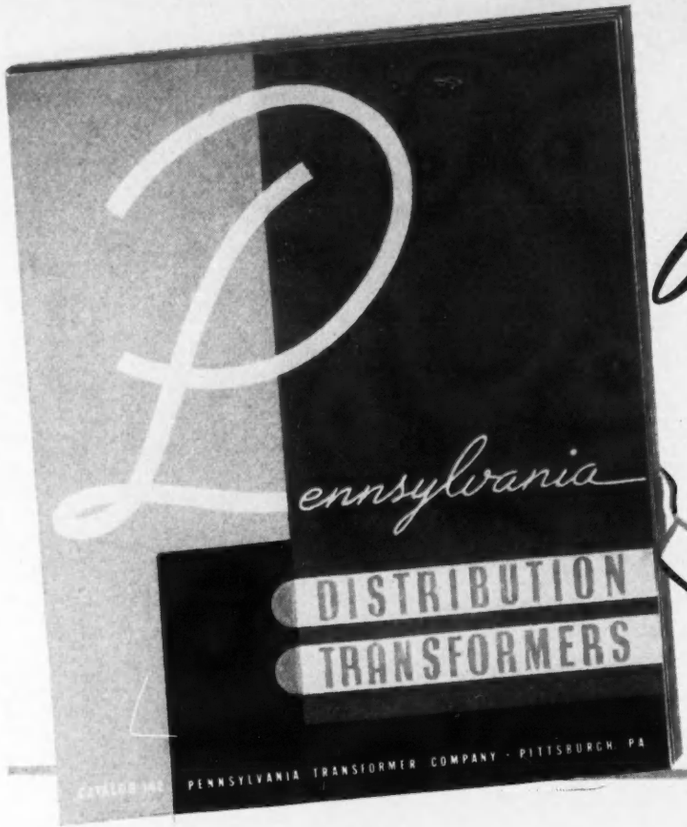




G&W

ELECTRIC SPECIALTY COMPANY

CABLE TERMINATING, SECTIONALIZING AND PROTECTING EQUIPMENT



Just Out!

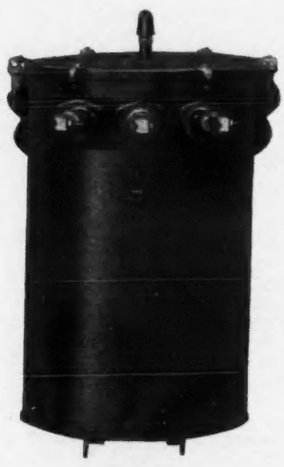
COMPLETE DATA ON OUR DISTRIBUTION TRANSFORMERS

- *E.E.I.-NEMA Standards Up to 100 Kva
- *ASKAREL
- *SUBWAY
- *INDUSTRIAL
- *HIGH VOLTAGE

You'll want this new book for your files

5 Kva.

15 Kva.


37½ Kva.

100 Kva.

32 Pages of Useful Information on:

Core and Coil Construction
Tank and Bushing Construction
High and Low Voltage Lead Assembly
Mountings and Hangers
Standard Accessories
Outline Drawings – Prices and Data

Write for your FREE COPY

PENNSYLVANIA TRANSFORMER CO., Pittsburgh, Pa.

Gentlemen: Please send me, without obligation, a copy of your new Distribution Transformer Catalog No. 142.

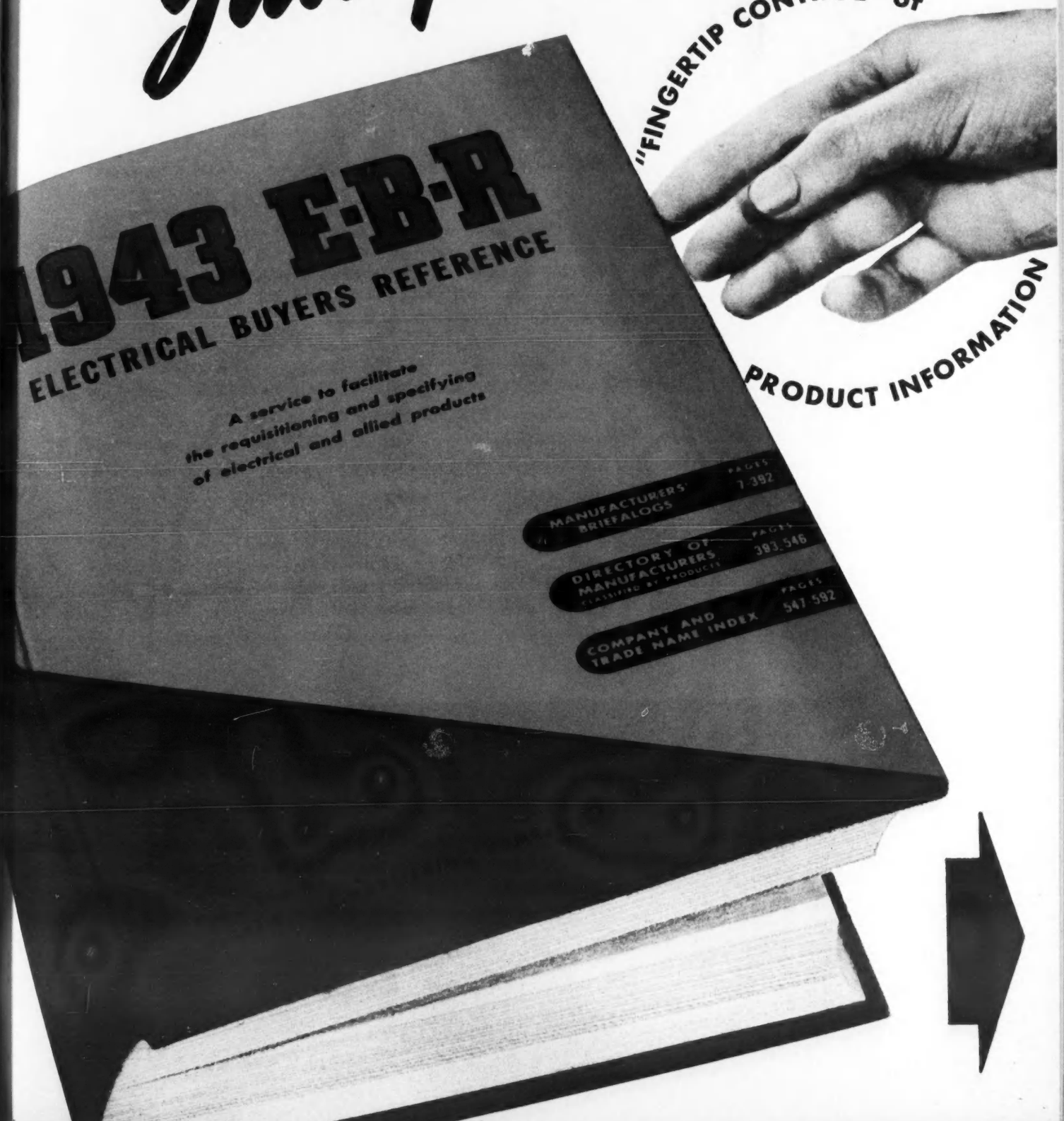
NAME_____
TITLE_____
COMPANY_____
STREET_____
CITY_____

Pennsylvania TRANSFORMER COMPANY

290 **Manufacturers cooperate to bring you latest revised product data**

Just published!

"FINGERTIP CONTROL" of PRODUCT INFORMATION


1943 E·B·R
ELECTRICAL BUYERS REFERENCE
A service to facilitate the requisitioning and specifying of electrical and allied products
MANUFACTURERS' BRIEFALOGS PAGES 7-382
DIRECTORY OF MANUFACTURERS CLASSIFIED BY PRODUCTS PAGES 383-546
COMPANY AND TRADE NAME INDEX PAGES 547-582

290 Manufacturers now bring you newly revised product data!

Things are happening so fast these days . . . product changes, use of new materials, priorities and other government restrictions . . . that even the most complete catalog file can be out-of-date today. Right now when you're busiest—perhaps with limited manpower or "green" help—the new 1943 ELECTRICAL BUYERS REFERENCE can be *so useful!* More *complete* than ever before, it contains the condensed catalogs of 290 manufacturers . . . simplified for today's unusual needs.

MANUFACTURERS BRIEFALOG* SECTION—Containing the condensed catalogs of no less than 290 electrical manufacturers. In addition to product specifications, here you will find listings of branch offices, warehouses, etc.—vital information for wartime planning, specifying and requisitioning.

CLASSIFIED DIRECTORY OF MANUFACTURERS—Here for quick reference you will find company addresses and trade names, arranged by product. Extensive cross-references to help you find the electrical and allied products made by more than 3,500 manufacturers. Bold face listings are used throughout to indicate the pages where each manufacturer's product data is given.

ALPHABETICAL INDEX OF TRADE & COMPANY NAMES—Complete with addresses. Starting with only a trade name or a company name, you can thus quickly locate the product data you need.

THESE ARE THE MANUFACTURERS serving you with newly revised catalog data in the 1943 E.B.R. . . .

Accurate Mfg. Co.
Acme Wire Co.
Adalet Mfg. Co.
Adam Electric Co., Frank
Adapti Co.
Aerovox Corp.
Air Controls Inc.
Akron Porcelain Co.
Alberene Stone Corp. of Virginia
Allen-Bradley Co.
Allen Co., L. B.
Allis-Chalmers Mfg. Co.
American Blower Corp.
American Brass Co.
American Coolair Corp.
American Felt Co.
American Phenolic Corp.
American Steel & Wire Co.
American Transformer Co.
Appleton Electric Co.
Artkraft Sign Co.
Asheville Mica Co.
Associated Research, Inc.
Atlantic Conduit Fittings Co.
Austin Co., M. B.
Auth Electrical Specialty Co.
Automatic Electric Co.
Baldor Electric Co.
Barkelew Electric Mfg. Co.

369 pages of BRIEFALOGS* for fast, "fingertip control"

*A BRIEFALOG is simply a modern method of cataloging, with condensed descriptions and specifications on all products salable in the field covered—plus branch office, distributor and warehouse addresses for quick follow-through.

The new 1943 ELECTRICAL BUYERS REFERENCE is *more useful* than ever before. Designed to serve industry and government at war, it gives you "fingertip control" for requisitioning and specifying electrical equipment . . . for finding out what you want to know—*fast!*

Yes, you'll be surprised when you discover how much time you save using the compact comprehensive 369 pages of condensed product data, easy-to-get-at and up-to-the-minute . . . *and all under one cover!* Put it to work the moment it lands on your desk.

MORE ON NEXT PAGE

Bartlett Mfg. Co.
Bead Chain Mfg. Co.
Beaver Pipe Tools
Becker Brothers Carbon Co.
Bell Lumber & Pole Co.
Bender Warrick Corp.
Bendix Aviation Corp.
Benjamin Electric Mfg. Co.
Bentley, Harris Mfg. Co.
Biddle Co., James G.
Brand & Co., William
Briegel Method Tool Co.
Bright Light Reflector Co.
Brooks Co., E. J.
Brown Co.
Brown Wood Preserving Co.
Bull Dog Electric Products Co.
Burke Electric Co.
Burlington Instrument Corp.

Burndy Engineering Co.
Bussmann Mfg. Co.

Callite Tungsten Corp.
Carboloy Co.
Carney & Co., B. J.
Carpenter Mfg. Co.
Champion Lamp Works, Div. Consolidated Electric Lamp Co.
Chance Co., A. B.
Chicago Expansion Bolt Co.
Chicago Transformer Co.
Clare & Co., C. P.
Clarostat Mfg. Co.
Cleveland Heater Co.
Clifton Mfg. Co.
Clover Co., F. G.
Conduit Pipe Products Co.
Connecticut Hard Rubber Co.

Connecticut Malleable Castings Co.
Continental-Diamond Fibre Co.
Cope, Inc., T. J.
Cornell-Dubilier Electric Corp.
C-O-Two Fire Equipment Co.
Couch Co., S. H.
Cramer Co., R. W.
Curtis Lighting, Inc.

Day-Brite Lighting Inc.
Dinion Coil Co.
Dongan Electric Mfg. Co.
Dossert & Co.
Dow Chemical Co.
Doyle, Inc., James W.
Drake Mfg. Co.
Driver Co., Wilbur B.
Dunn, Inc., Struthers

Eagle Electric Mfg. Co.
Eastern Specialty Co.
Edwards & Co.
Efficiency Electric & Mfg. Co.
Electric Furnace Co.
Electric Power Equipment Corp.
Electric Soldering Iron Co.
Electrical Engineers Equipment Co.
Erie Electric Co.

Fairbanks, Morse & Co.
Fargo Mfg. Co.
Fast & Co., John E.
Feedrail Corp.
Fibre Conduit Co.
Fidelity Machine Co.
Fleur-O-Lier Mfrs.
Flexo Wire Co.
Formica Insulation Co.

Four Wheel Drive Auto Co.
Frankel Connector Co.
Fullman Mfg. Co.

Gardner Electric Mfg. Co.
G. C. A. Mfg. Co.
Gedney Electric Co.
General Electric Co.
Bridgeport
Schenectady
Lamp Dept.
General Plate Div. of
Metals & Controls Corp.

Gleason & Co., J. L.
Graybar Electric Co.
Greenlee Tool Co.
Guardian Electric Mfg. Co.
Guth Co., Edwin F.

Hansen Mfg. Co.
Hardwick, Hindle, Inc.
Haydon Mfg. Co.
Heinemann Circuit Breaker Co.
Herwig Co.
Hesse & Co., W. A.
Homer Commutator Corp.
Hoskins Mfg. Co.
Hullhorst Micro Tool Co. (Div. of
Toledo Standard Cummutator Co.)

Ideal Commutator Dresser Co.
Illinois Electric Porcelain Co.
Ilsco Copper Tube & Products, Inc.
Imperial Porcelain Works, Inc.
Insl-X Co.
Insulation Mfrs. Corp.
Insulation & Wires, Inc.
International Resistance Co.
Irvington Varnish & Insulator Co.
I-T-E Circuit Breaker Co.

J-B-T Instruments, Co.
Jefferson Electric Co.
Johns-Manville
Johnson Bronze Co.

Kato Engineering Co.
Kearney Corp., James R.
Kees Mfg. Co., F. D.
Kellogg Switchboard & Supply Co.
Kellems Co.
Keystone Carbon Co.
Killark Electric Mfg. Co.
Klein & Sons, Mathias
Knox Porcelain Corp.
Krueger & Hudepohl
Kuhlman Electric Co.
Kulka Electric Mfg. Co.
Kwikon Co.

Lapp Insulator Co.
Leeds & Northrup Co.
Leviton Mfg. Co.
Lidseen, Inc., Gustave
Lighting Products, Inc.
Lint, Clyde W.
Locke Insulator Corp.
Lloyd Products Co.
Lowell Wrench Co.

Macallen Co.
Magic Electro Welder Mfg. Co.
Magnetic Windings Co.
Marathon Chemical Co.
Martin & Sons, H. P.
McGill Mfg. Co.
McIntire Connector Co.
Metropolitan Device Corp.
Metropolitan Electric Mfg. Co.
Mica Insulator Co.
Micro Switch Corp.
Mineralac Electric Co.
Misener Mfg. Co.
Mitchell-Rand Insulation Co.
Moloney Electric Co.
Monitor Controller Co.
Morganite Brush Co.
Murray Mfg. Co., D. J.
M. & W. Electric Mfg. Co.

National Acme Co.
National Carbon Co.
National Pole & Treating Co.
National Varnished Products Corp.
National Vulcanized Fibre Co.
Naugle Pole & Tie Corp.
New England Mica Co.
New Jersey Wood Finishing Co.
Newport News Shipbuilding &
Dry Dock Co.
Noma Electric Corp.
North American Electric Lamp Co.
Norton Electrical Instrument Co.

Ohio Carbon Co.
Ohmite Mfg. Co.
Okonite Co.
Oliver Iron & Steel Corp.
Onan & Sons, D. W.
Oster Mfg. Co.
Owens-Corning Fiberglas Corp.
Owens-Illinois Glass Co.
Overbagh & Ayres Mfg. Co.
O. Z. Electrical Mfg. Co.

Pacific Electric Mfg. Corp.
Page & Hill Co.
Paine Co.
Partridge Lumber Co., T. M.
Penn-Union Electric Corp.
Pennsylvania Transformer Co.
Philadelphia Electrical & Mfg. Co.
Plainville Electrical Products Co.
Porcelain Insulator Corp.
Porcelain Products, Inc.
Portland-Monson Slate Co.
Post-Glover Electric Co.
Pyramid Products Co.

Railway & Industrial Engineering Co.
Rawlplug Co.
R-B-M Manufacturing Co.
Reliable Electric Co.
Reliance Automatic Lighting Co.
Reliance Electric & Engrg. Co.
Revere Electric Mfg. Co.
Ridge Tool Co.
RLM Standards Institute, Inc.
Rockbestos Products Corp.
Roebling's Sons Co., John A.
Roller-Smith Co.
Ruberoid Co.
Rusgreen Mfg. Co.

Sangamo Electric Co.
Schwarze Electric Co.
Seyler Mfg. Co.
S. & G. Mfg. Co.
Shallcross Mfg. Co.
Sherman Mfg. Co., H. B.
Signal Engineering & Mfg. Co.
Simplet Electric Co.
SKF Industries, Inc.
Sola Electric Co.
South Bend Current Controller Co.
Southern States Equipment Corp.
Southern Wood Preserving Co.
Spang Chalfant, Inc.
Specialties, Inc.
Speer Carbon Co.
Spero Electric Corp.
Stackpole Carbon Co.
Standard Transformer Co.
Standard Transformer Corp.
Stanley Works
Star Porcelain Co.
States Co.
Steel City Electric Co.
Stewart Iron Works Co.
Sticht Co., Herman H.
Superior Carbon Products, Inc.
Super Tool Co.
Sylvania Electric Products Inc.
Synthane Corp.
Syntron Co.

Taylor Fibre Co.
Thermador Electrical Mfg. Co.
Thomas & Skinner Steel Products Co.
Thompson Electric Co.
Thompson & Son Co., Henry G.
Toledo Pipe Threading Machine Co.
Tork Clock Co.
Triangle Conduit & Cable Co.
Triplett Electrical Instrument Co.
Trumbull Electric Mfg. Co.

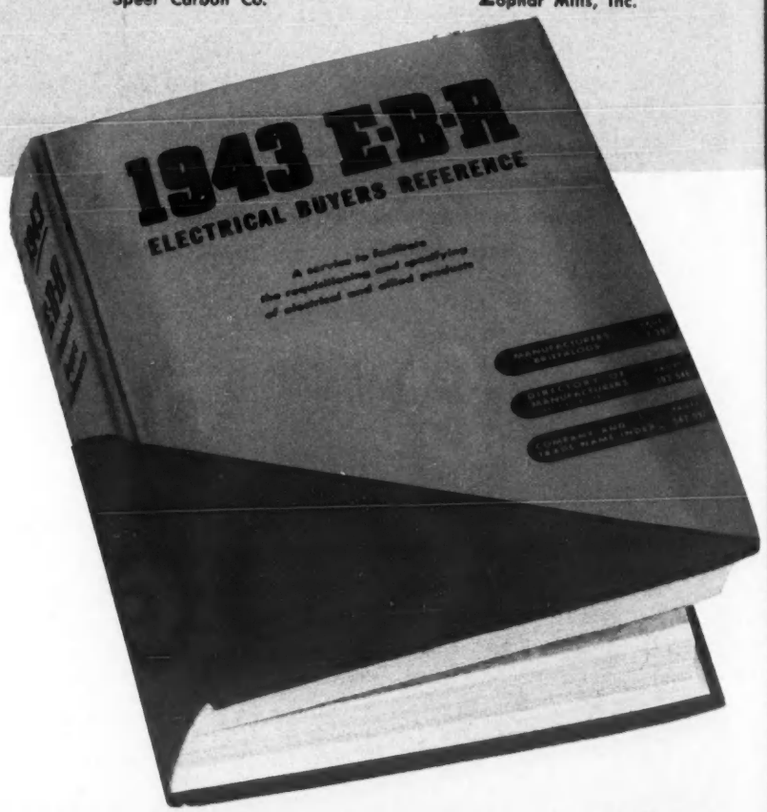
Union Electrical Porcelain Works, Inc.
United States Rubber Co.
Unistrut Corp.
Uptegraff Mfg. Co., R. E.
Utah Radio Products Co.

Valentine Clark Corp.
Van Cleef Bros.
Victor Insulators, Inc.

Ward Leonard Electric Co.
Ware Brothers
West Dodd Lightning Conductor Corp.
Westinghouse Electric & Mfg. Co.
Lamp Division
Westinghouse Electric Supply Co.
Weston Electrical Instrument Corp.
Wheeler Reflector Co.
Wilmington Fibre Specialty Co.
Wolfe & Mann Mfg. Co.
Wolverine Tube Div., Calumet & Hecla
Consolidated Copper Co.
Wright & Sons, Wm. E.
Wurdack Electric Mfg. Co., Wm.

Zophar Mills, Inc.

For fast, "fingertip control" of 1943 planning, specifying and requisitioning . . . look in* ELECTRICAL BUYERS REFERENCE *first.

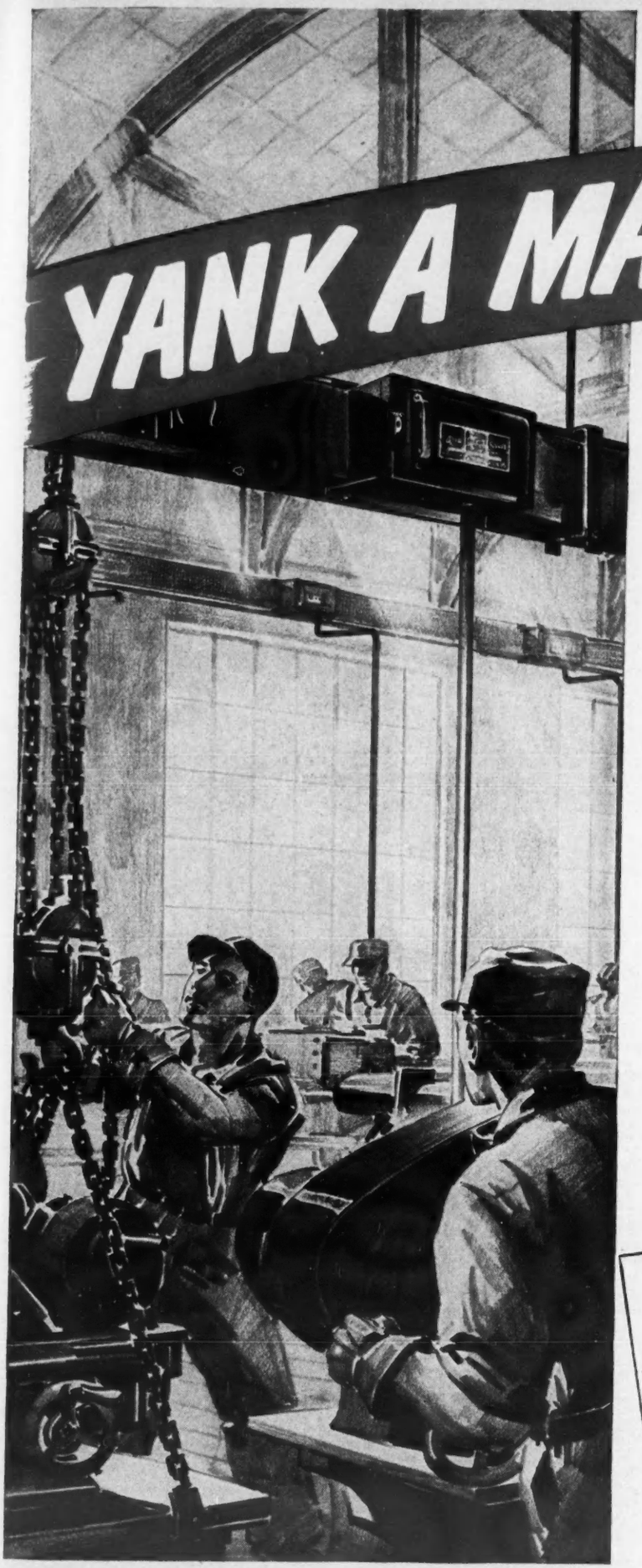


Distribution of E-B-R has no connection or relationship with subscriptions to any McGraw-Hill publication. Every year E-B-R is sent to approximately 30,000 large electrical contractors, electrical wholesalers, large industrial plants, electric utilities, electrified railroads, mines, government services.

McGRAW-HILL PUBLISHING CO., 330 W. 42d ST., NEW YORK, N. Y.

E·B·R

THE ELECTRICAL GUIDE FOR INDUSTRY AND GOVERNMENT AT WAR



YANK A MACHINE

...without cutting power

Moving machinery—changing shop set-ups—is an everyday job in modern war plants. But it's a quick and easy job in plants equipped with sectionalized, prefabricated "plug-in" Bus Duct.

No cutting, taping or other fabrication is necessary in making the original installation — or in changing the location of a machine or a whole production battery.

Just move the circuit protective "plug" right with the machine, mount it on the Bus Duct at the "plug-in" opening nearest the new location — and the job is done without cutting power, interrupting production, or taking the dangerous alternative of tapping in "hot."

All through America's non-stop production drive Bus Duct is saving countless man-hours, multiplying efficiency, protecting against fire and sabotage, safeguarding human life . . . and all this with a minimum use of critical materials.

Modern Bus Duct is an integral part of the machine tools it serves. Small wonder that it has become a *necessity* in present-day mass production.

BUY MORE WAR BONDS—SALVAGE ALL SCRAP METAL

BULLDOG
ELECTRIC PRODUCTS CO.
Detroit, Michigan
BullDog Electric Products of Canada, Ltd., Toronto, Ontario
Field Engineering Offices in All Principal Cities

BULLDOG "PLUG-IN" SYSTEMS—THE ARTERIES THAT SUPPLY POWER AND LIGHT FOR WAR PRODUCTION

Amazing NEW GLASS

mail coupon today for

NEW CORNING MULTIFORM GLASS INSULATION

REPLACES STEATITE, PORCELAIN AND OTHER ELECTRICAL INSULATION MATERIALS

ENGINEERING PROPERTIES OF PYREX MULTIFORM GLASS VS. OTHER INSULATING MATERIALS

GLASS CODE		790	7761	707	774	Steatites*	Electrical Porcelains*
GLASS TYPE		Multiform Glass	Multiform Glass	Multiform Glass	Conventional Glass		
ENGINEERING PROPERTIES	UNIT						
DENSITY	—	2.15	—	2.10	2.23	2.5—2.8	2.3—2.5
SOFTENING TEMPERATURE	°C	—	—	—	820	1250—1400	1500—1600
MAX. OPERATING TEMPERATURE	°C	800	500	425	500		
LINEAR EXPANSION (0-300°C)	per °C X 10^{-7}	8.5	—	32	32	60—90	30—50
WATER ABSORPTION—24 HRS.	%	<.01	<.01	<.01	NONE	0—0.1	0—2.0
MODULUS OF RUPTURE —ANNEALED GLASS	LBS./IN.^{2} X 10^3	5	7	7	10	—	6—12
MODULUS OF RUPTURE —SPECIAL PROCESS	LBS./IN.^{2} X 10^3	—	—	12	18	17—24	
VOLUME RESISTIVITY		—	—	—	14.7	14	12—14
LOG R AT 20°C	OHMS PER CM. CUBE	9.3	—	—	8.1	9—14	7—10
LOG R AT 250°C		7.8	—	—	6.7	8—13	6—8
LOG R AT 350°C		4.0	4.0	4.0	4.65	5.5—7.5	5.0—7.5
S. I. C.—20°C—1 MEG.	—	0.18	0.11	0.10	0.42	0.03—0.20	0.70—1.2
P. F. —20°C—1 MEG.	%	0.72	0.44	0.40	1.95	0.15—1.24	3.5—9.0
L. F. —20°C—1 MEG.	%	>500	>500	>500	HIGH	200—300	200—280
DIELECTRIC STRENGTH	VOLTS/MIL						

*Data from Rigterink, M.D., *Review of Scientific Instruments*, vol. 12, no. 11, 527-534 (1941).

INSULATORS . . .
free sample and data!

ALMOST NO LIMITS ON SIZE OR SHAPE

IF you need insulators, here's what you've been waiting for! Corning Glass Research announces new types of electrical insulators—Pyrex brand Multiform Glassware. Its general characteristics include low loss factor, high dielectric strength, negligible water absorption, adequate mechanical strength. For example, Multiform glass Number 790 (see chart on opposite page) meets requirements of U. S. Navy Standard RE-13A-317F. And all Multiform glasses comply with the proposed A.S.A. American War Standard on Radio Insulation Materials of Low Dielectric Constant.

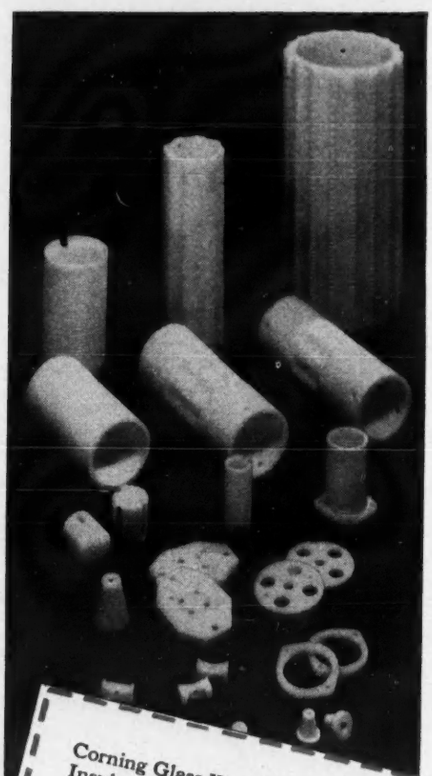
The characteristics of these glasses plus Corning's new fabrication methods make possible an extremely wide range of shapes and sizes. General dimensional tolerances are: large or heavy pieces, intricate shapes, hollow cylindrical sections—±2.0% or 0.010″; flat plates, solid rods, discs, beads, bushings—±1.0% or 0.005″, except thickness which should be ±4% or 0.005″.

Best of all, glass-making materials are still fairly plentiful. Pyrex brand Multiform Insulators are available NOW! Mail the coupon today for a free sample and a descriptive booklet just off the press.

* * *

Pyrex brand Multiform Glassware is particularly adapted to manufacture in such shapes as solid cylinders, plates with one or many holes, large heavy-walled articles, coil forms, hollow cylindrical beads, and many other articles in a wide variety of shapes. In size and weight, these insulators run the gamut from small beads, several thousand to the pound, to large pieces with maximum dimensions up to 15″, weighing 25 pounds each or more.

MAIL COUPON TODAY!



Corning Glass Works, Corning, N. Y.
Insulation Division, Dept. W-11

Please send me immediately, without charge, sample and descriptive booklet on new Pyrex brand Multiform Insulators.

Name.....

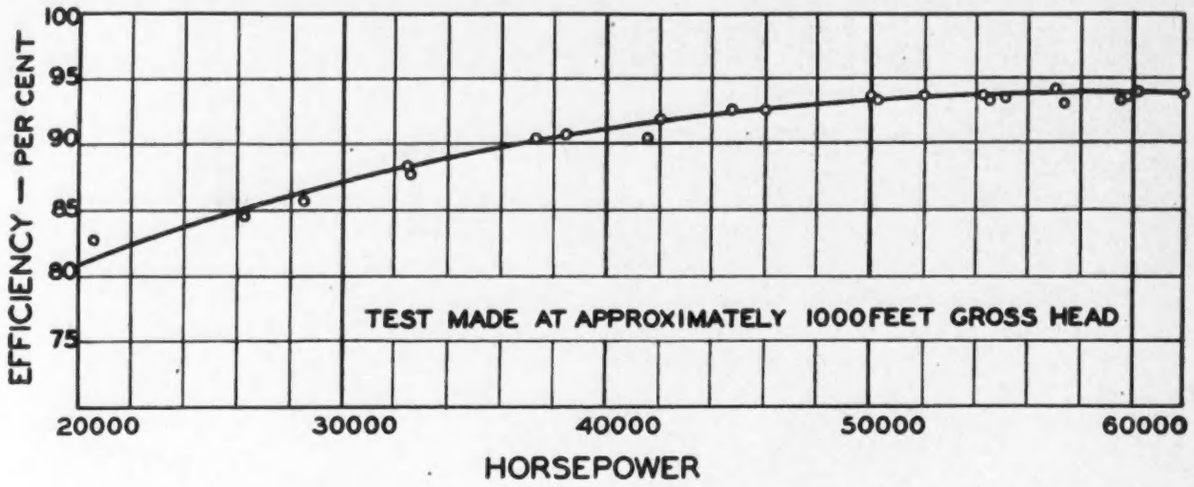
Company.....

Street Address.....

City.....State.....

Pyrex Insulators
BRAND

"PYREX" is a registered trade-mark and indicates manufacture by Corning Glass Works



FIELD TEST CURVE

for

60,000 H.P.—925′ NET HEAD—450 R.P.M.

VERTICAL FRANCIS TURBINE

Built by

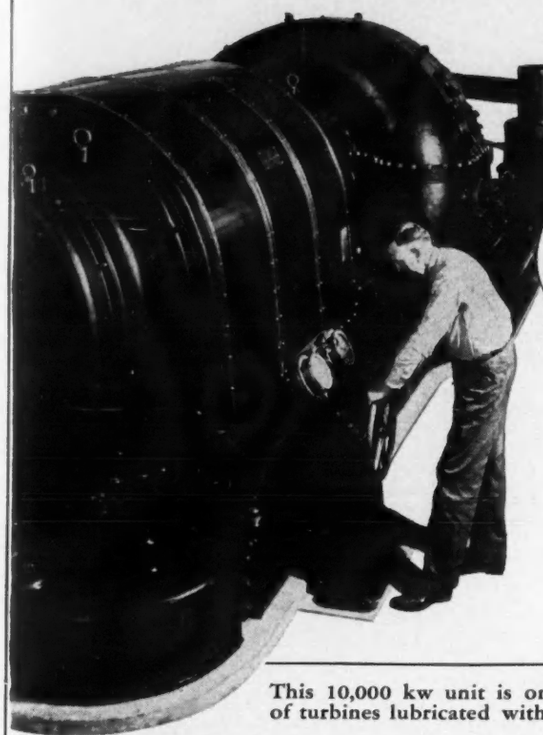
NEWPORT NEWS SHIPBUILDING AND DRY DOCK COMPANY

HYDRAULIC TURBINE DIVISION

Newport News, Virginia

Our facilities for building turbines, valves, rack rakes, gates, etc., are now in use for constructing ships for the Navy.

The unequaled refining power of the Alchlor Process produces this unmatched turbine lubricant:



GULFCREST OIL

This 10,000 kw unit is one of hundreds of turbines lubricated with Gulfcrest Oil.

THE performance of a turbine lubricant depends largely on how it is refined. That is why you insure better lubrication for your turbines when you use the only Alchlor-Processed turbine lubricant—Gulfcrest Oil.

For the Alchlor Process not only removes the general run of impurities present in all crude oils, but eliminates oxidation catalysts and rearranges the molecular structure of certain hydrocarbons. This unequaled refining power of the Alchlor Process produces a turbine oil with highest resistance to oxidation, highest resistance to acidity and sludge, and highest kilowatt-hour performance. Gulfcrest Oil is the world's finest oil for turbine lubrication!

Send the coupon below for the story of Gulfcrest Oil and what it can do for you — no obligation, of course.

FOR VICTORY BUY UNITED STATES SAVINGS BONDS AND STAMPS

GULF INDUSTRIAL LUBRICATION

Gulf Oil Corporation · Gulf Refining Company EW
3800 Gulf Building, Pittsburgh, Pa.

Please send me my copy — no charge — of the brochure "Gulfcrest Turbine Oil."

Name.....

Company.....

Title.....

Address.....

• You'll subscribe to that, we know: *Nothing but the best will do for the American Soldier.*

But are you carrying the thought out to its logical conclusion?

In your territory are plants doing vitally important war work. It is just possible – what with the concentration on attaining peak production and top quality – that some of them are doing it the hard way.

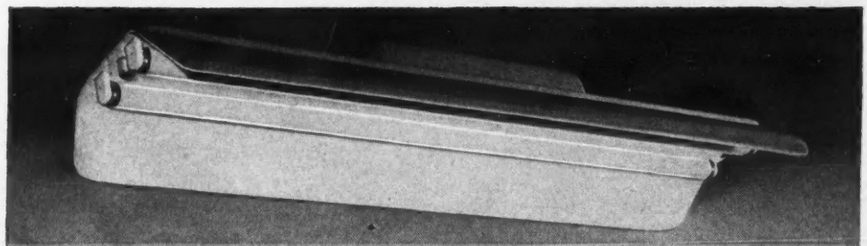
A survey by you would find the plants handicapped by inadequate lighting. You can show them how industrial accidents lurk in shadows, how glare multiplies rejects.

Tell them about cool, shadowless, glareless fluorescent – nothing but the best for industrial lighting.

It may be that plants need to know that existing circuits can usually be switched to fluorescent without additional wiring, that fluorescent gives more than twice as much light for the same wattage.

By introducing fluorescent to plants with lighting handicaps, you serve your country. And you can make a permanent customer by specifying Sylvania Fluorescent Lamps – not only for new installations but for replacements in existing fluorescent systems.

Sylvania fluorescent specialization has resulted in lamps without superior on point of color, life, lumen output, freedom from end-bands and low cost.



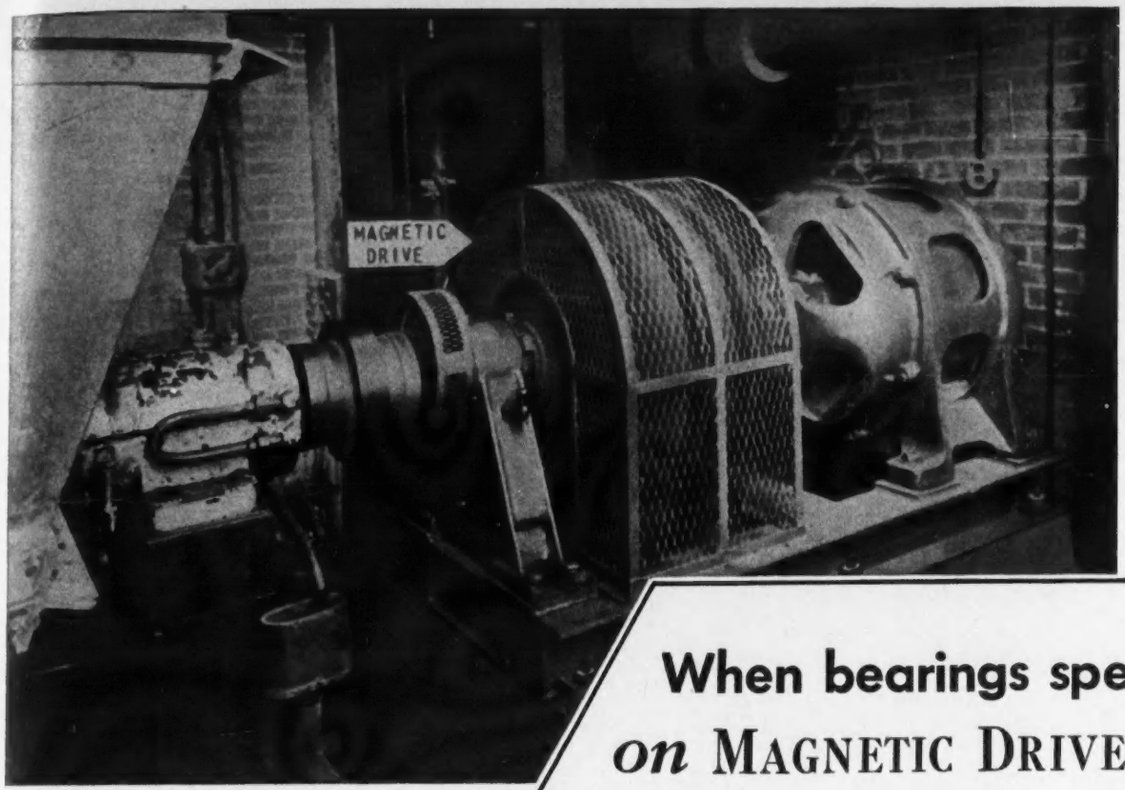
PRIORITY NOTE: New fluorescent lighting equipment can be secured when it can be shown to be helpful to war production. Better lighting, scientifically applied, almost invariably improves production. Therefore, it is relatively easy to replace old lighting systems with fluorescent. If you wish, our representative will gladly assist you in securing the necessary priority rating. Write Department EW-1.

SYLVANIA

ELECTRIC PRODUCTS INC.

formerly Hygrade Sylvania Corporation
Salem, Mass.

Incandescent Lamps, Fluorescent Lamps, Fixtures and Accessories, Radio Tubes, Electronic Devices.



• *Built by*
ELECTRIC MACH'Y MFG. CO.

When bearings speak *on* MAGNETIC DRIVES

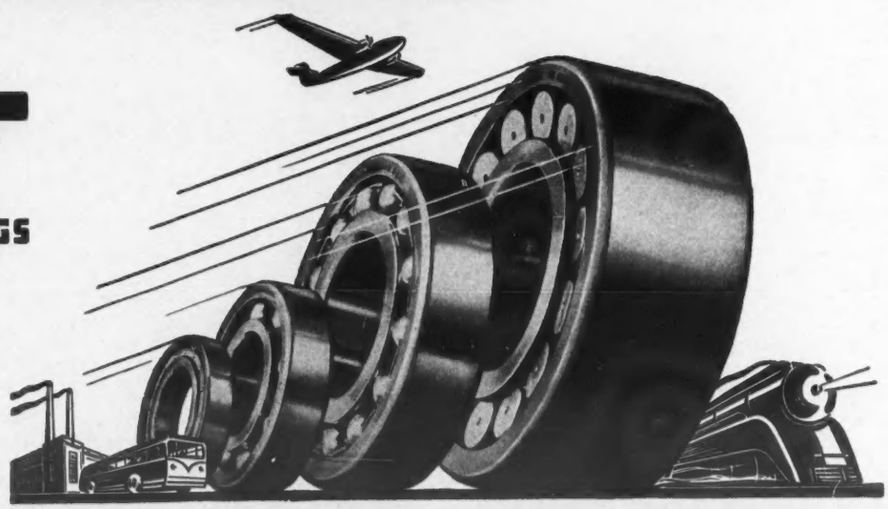
If the SKF Bearings on this Magnetic Variable-Speed Drive could speak, one of them would say: "I'm an SKF Spherical Roller Bearing working on the pedestal of this compact Magnetic Drive which is interposed between the motor and the fan to supply an adjustable, micro-step speed control. I'm the bearing with built-in alignment that compensates for shaft deflections, distortions and weave without binding." Two others would add: "We're SKF Cylindrical Roller Bearings mounted between ring and magnet." Two more SKF's would say they work on the motor shaft. And all would chorus: "With proper care and lubrication, we'll give trouble-free performance for the duration—no matter how far away the duration may be."

5130

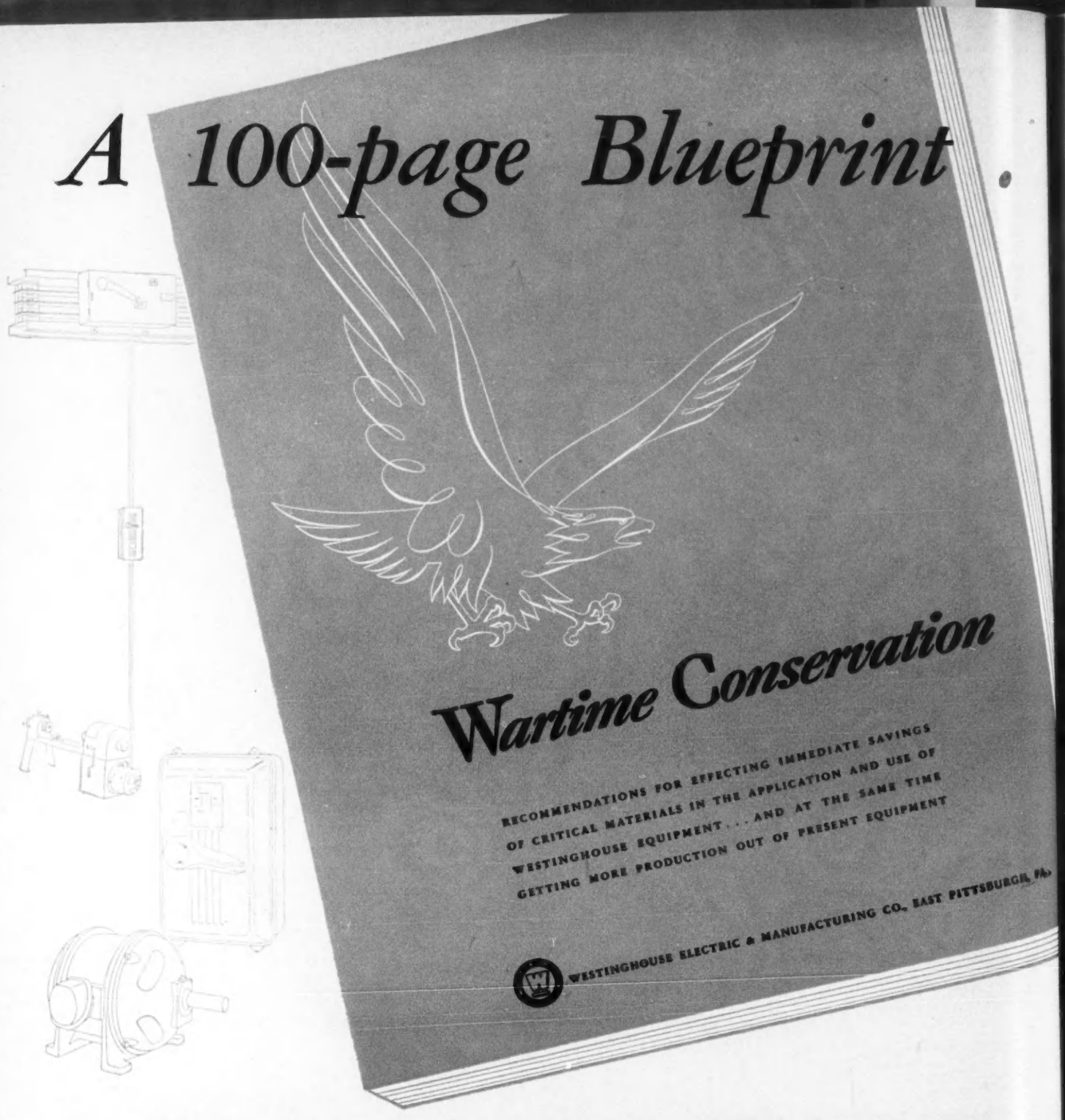
SKF INDUSTRIES, INC., PHILA., PENNA.

SKF

BALL & ROLLER BEARINGS



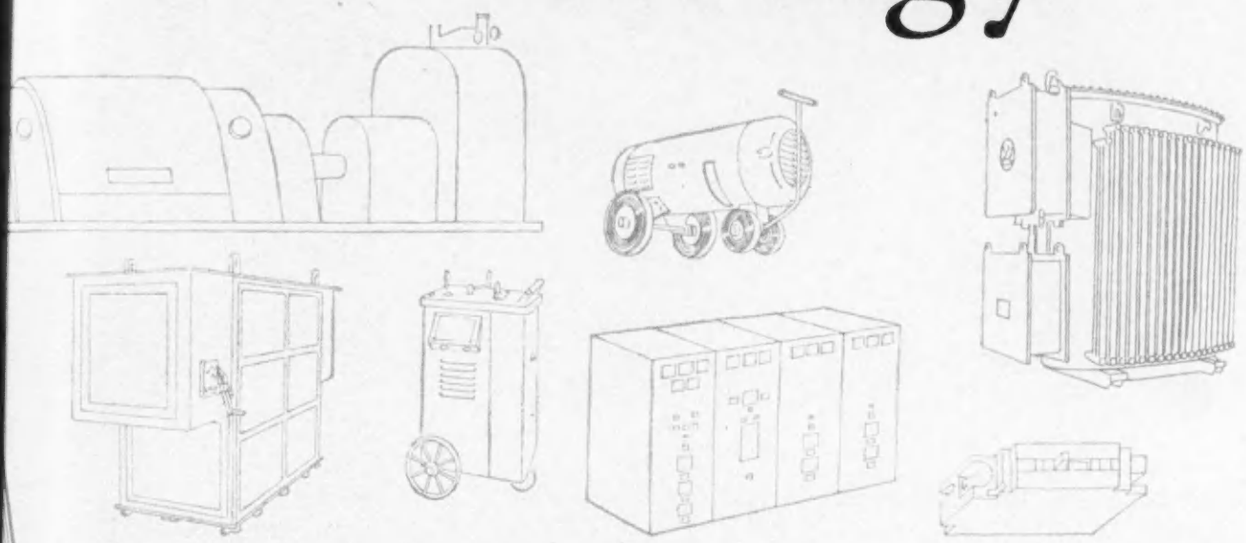
A 100-page Blueprint


Wartime Conservation
RECOMMENDATIONS FOR EFFECTING IMMEDIATE SAVINGS OF CRITICAL MATERIALS IN THE APPLICATION AND USE OF WESTINGHOUSE EQUIPMENT . . . AND AT THE SAME TIME GETTING MORE PRODUCTION OUT OF PRESENT EQUIPMENT
WESTINGHOUSE ELECTRIC & MANUFACTURING CO., EAST PITTSBURGH, PA.

THIS BOOK CONTAINS DEFINITE RECOMMENDATIONS...

- **From generator to motor . . .** Critical Material savings in selection, application and use of electrical equipment.
- **On the production line . . .** New methods of speeding production made possible by Westinghouse developments.
- **Keep 'em running!** Maintenance and repair service as an aid to production.
- **Replacement—not substitution . . .** Micarta and Prestite are superior to the Critical Materials which they replace.
- **All in the day's work . . .** How Westinghouse is saving Critical Materials in its own manufacturing operations . . . including complete plans for a systematic industrial scrap salvage campaign.

. . . to help you plan your Conservation Strategy

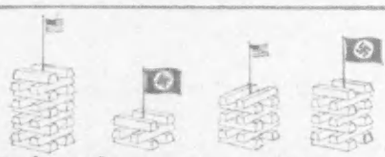


We no longer are "too rich" to worry—the Axis has more Critical Materials than we do.

To help America save Critical Materials . . . to assist industry in planning its conservation strategy, Westinghouse has published an authoritative 100-page book. It contains recommendations for effecting immediate savings of Critical Materials in the selection, application and use of electrical equipment . . . and at the same time getting more production from present equipment.

Write for your copy today (company letterheads, please!). Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N. J-90460

Comparison of United Nations and Axis resources prior to war and today



	Before the war		Now	
	United Nations	Axis	U. Nations	Axis
STEEL	73%	27%	50%	50%
COPPER	94%	6%	83%	17%
TIN	99+%	1–%	35%	65%
ALUMINUM	68%	32%	42%	58%
PIG IRON	75%	25%	44%	56%
TUNGSTEN	95%	5%	65%	35%
MAGNESIUM	44%	56%	32%	68%

Westinghouse

PLANTS IN 25 CITIES ... OFFICES EVERYWHERE

DRIVING HOME

WHAT THE INDUSTRY IS DOING FOR AMERICA

General Cable has been making *your* report to the Nation, in a series of advertisements you must have read. We are endeavoring to spotlight the vital story of what the Electrical Industry is doing as a prime participant in our national effort. We are telling America through the pages of influential magazines and newspapers what the power utilities as well as the contractors and electrical supply houses have accomplished. Your example of teamwork and determination should be known by everyone and remembered when the job is done.

GENERAL CABLE GENERAL CABLE GENERAL CABLE

General Cable Corporation Sales Offices are located at Atlanta, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Dallas, Detroit, Houston, Kansas City (Mo.), Los Angeles, New York, Philadelphia, Pittsburgh, Rome (N.Y.), St. Louis, San Francisco, Seattle, Washington (D.C.)

A SHOCK for Mr. Hitler

THIS is no mere play on words. Ours is a war of production... of armaments, of guns, of ships, of war materials. It is a war of speeded-up manufacturing... of machines and machinery.

And back of machinery is power... electric power that keeps production humming. Truly, the crushing blow that will eventually bring the Axis to its knees will come from the power of electricity as much as from the power of explosives. Yes, the stunning effect of this electrical power may well be called "a shock for Mr. Hitler".

Where is it coming from? Whence this gigantic massing of electric power from the Nation's generating plants? Whence the supply to meet the pyramided demand for wires, cables, switches, terminals... the thousand and one items that go into the making, transmitting and using of electrical power?

It came out of the teamwork that is the American way of doing things. The power companies threw into it their ready-and-waiting plans for plant expansion – for interconnection of systems, for unleashing their pools of power. The electrical manufacturers came through with increased production. The electrical supply warehouses looked after the distribution of equipment to meet the time schedules.

And back of it all, Washington guided, coordinated and applied the pressure where needed. To the War Production Board must go a lion's share of the credit. For the miracle has been wrought. Wherever a machine was installed in America's far-flung war-production line – there the wiring and the power were ready and waiting to start the wheels turning.

The Electric Power in back of American industry packs a wallop – an electrical wallop – a terrific "shock for Mr. Hitler".

☆ Not just one shock for Hitler... but a Series of JOLTS!

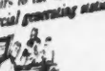
Nearly half of the entire productive capacity of all our industries breaking all records in turning out war material. . . .

More than 50% of the world's greatest concentration of Electric Power working to lick the Axis.

An Electric Utility industry with systems interconnected, fuel reserves accumulated, water power husbanded – Keeping pace with any war-industry expansion.

Utility Engineers bringing typical resourcefulness into play when power loads mount – ready to find ways to push boiler efficiencies beyond all previous limits, to install new-type cables to deliver the extra power. . . .

Newly built hydro-electric plants adding their to the vast output of the commercial generating stations.



Armies of skilled electrical contractors out on the industrial firing line, installing the wiring for constantly expanding production – guns, shells, tanks, ships, planes! . . .

Men, pledging their skill to keep every electric installation in AAA maintenance condition.

GENERAL CABLE CORPORATION

Manufacturing Plants from Coast to Coast

ARMY E NAVY

Bare, Weatherproof and Insulated Wires and Cables for Every Electrical Purpose

to withstand —
HEAVIER WAR-TIME LOADS

THE De Laval Insulating Oil Purifier materially reduces the cost of maintaining transformer and circuit breaker oil at high dielectric strength. The time and expense of servicing each individual piece of apparatus is reduced, and more frequent dehydration of the oil to maintain it at uniformly higher dielectric value becomes economically possible.

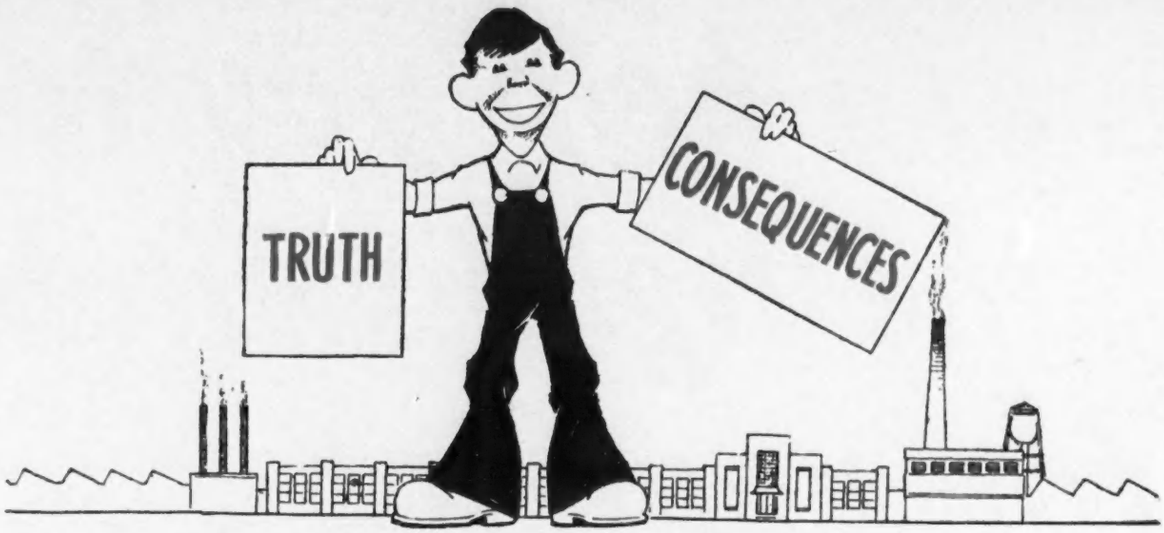
De Laval Insulating Oil Purifiers assure high-test oil at a single pass and at high capacity. Water is continuously discharged and oil is purified at relatively low temperature. High efficiency of purification is maintained during long runs.

Automatic oil flow control and thermostatic heat regulation enable practically automatic operation. This feature is enhanced by the fact the De Laval Purifier does not require the aid of a blotter press in purifying transformer oil. A press may be used in series with the purifier for removing colloidal carbon from circuit breaker oil.

Portable and stationary units, available in several sizes, are described in Bulletin No. 107.

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York — 427 Randolph St., Chicago
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco
THE DE LAVAL COMPANY, Limited
Montreal — Peterborough — Winnipeg — Vancouver

DE LAVAL
INSULATING OIL PURIFIERS



TRUTH Your War machinery is destined to feel the terrific strain of peak-year operation, which will result in big and little breakdowns calling for electrical repairs.

CONSEQUENCE Your production will lag until you get the essential repair materials.

TRUTH Your local Electrical Wholesaler stocks the necessary materials for just such urgent contingencies.

CONSEQUENCE This Wholesaler will bring you quicker action and more satisfactory service than if you attempted to deal with sundry and numerous manufacturers frantically busy with their *own* War schedules.

TRUTH Your Electrical Wholesaler stands ready to give you personalized and resourceful emergency service day or night.

CONSEQUENCE He has firmly established himself as indispensable to the Victory War Program.

Under the T & B Plan all T & B products are distributed exclusively through the Electrical Wholesaler. The T & B Wholesaler reduces the manufacturer's selling costs, thereby reducing the cost of all electrical equipment to the user.

Write for new detailed folders on T & B Maintenance and Repair Lines

Address

THE THOMAS & BETTS CO.

INCORPORATED

MANUFACTURERS OF ELECTRICAL FITTINGS SINCE 1899

ELIZABETH, NEW JERSEY

In Canada: The Thomas & Betts Co. Ltd. Montreal

. . . To help you to the right switch for your job . . .

HERE'S A NEW PUBLICATION

Complete—concise—arranged to save you valuable time. It lists standard insulators of all types and in all strength classes—with each type and class so grouped that the complete technical data is in a single table.

If you want *full* information on switch and bus insulators you must have this catalog. Nowhere else is such a wealth of pertinent facts available.

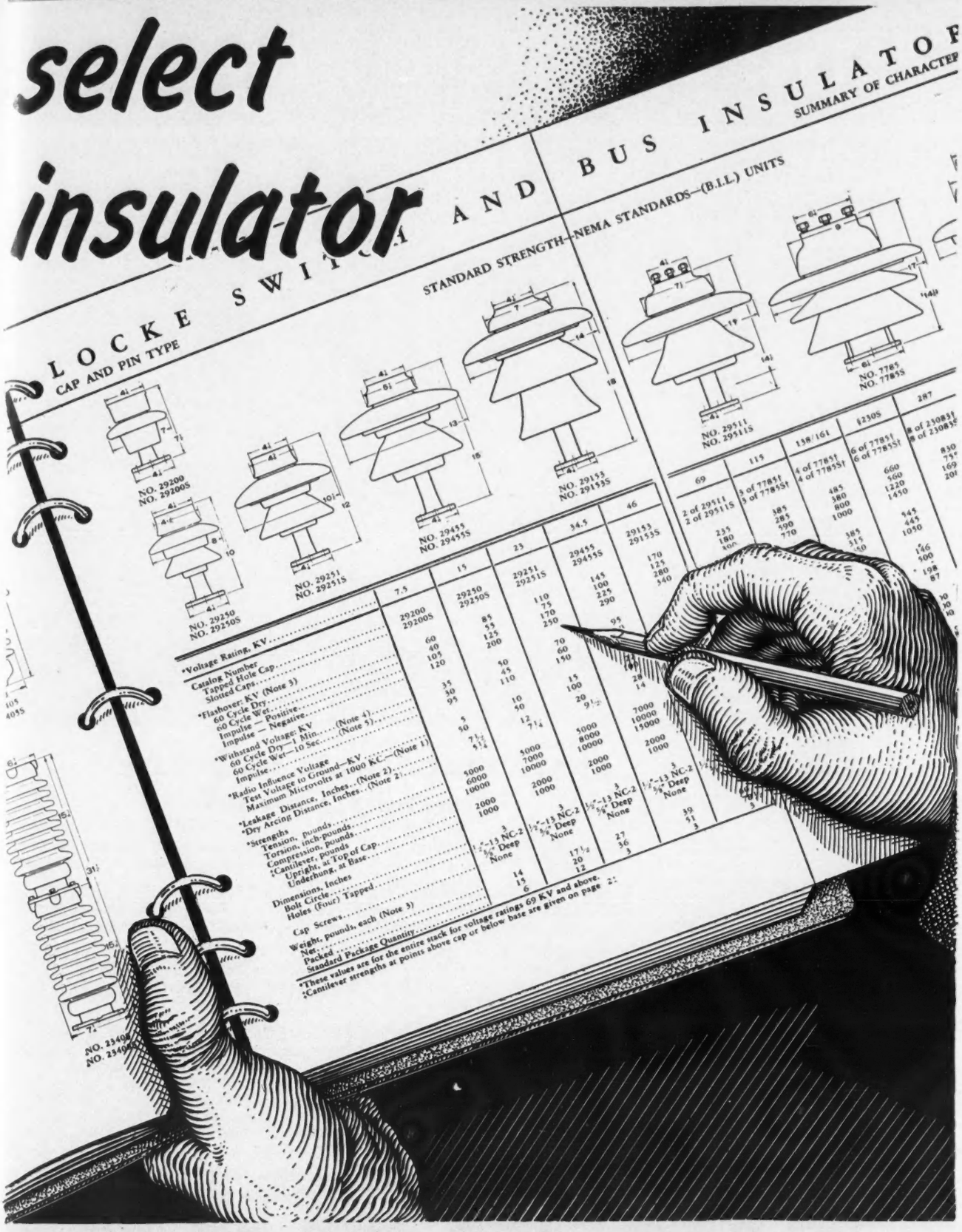
If you have not already received your copy write for it today. And remember that whenever you specify Locke Switch Insulators you are specifying the ultimate in economy, life, dependability and trouble-free operation.

Locke

PORCELAIN INSULATORS

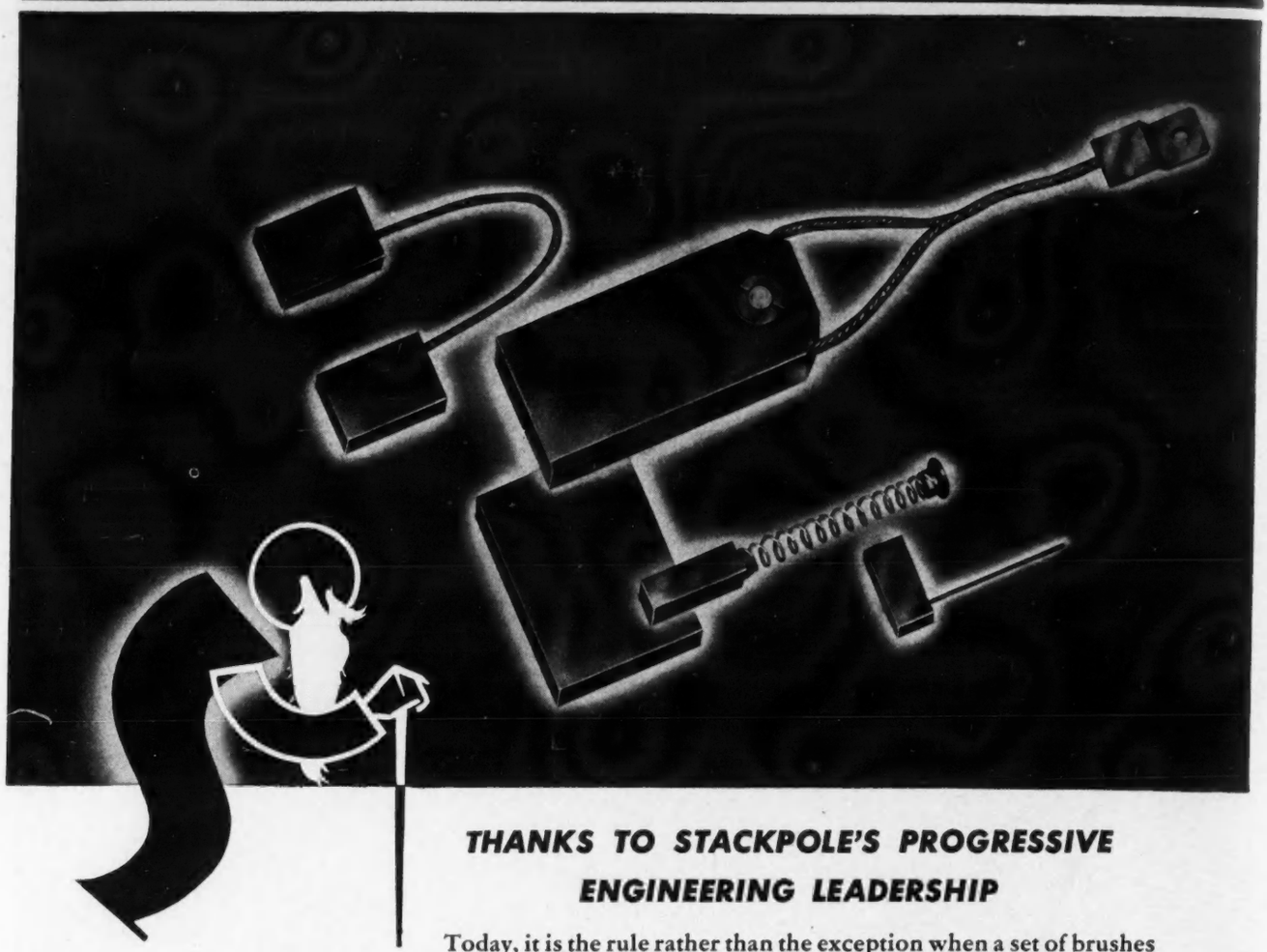
LOCKE INSULATOR

select insulator



CORPORATION BALTIMORE MARYLAND

BETTER BRUSHES *for Today's Jobs*



THANKS TO STACKPOLE'S PROGRESSIVE ENGINEERING LEADERSHIP

Today, it is the rule rather than the exception when a set of brushes lasts the entire life of a fractional horsepower motor or generator.

Even more important—if less spectacular, however—are the Stackpole-engineered brush improvements for heavy-duty equipment. Progressing steadily over more than a third of a century, these have played an increasingly important part in paving the way for greater capacity equipment in less weight, higher speed operation, better insulation, and generally improved performance under more exacting conditions.

To the careful buyer, the consistency of these Stackpole developments is significant. It means that brush problems don't stay answered. Last year's answer may be obsolete today. And, certainly, it means that it pays to check brush requirements at frequent intervals with the latest that Stackpole engineering may have to offer.

STACKPOLE CARBON COMPANY, ST. MARYS, PENNA.

Other Stackpole Molded Products

Molded Rare Metal Contacts • Carbon, Graphite, and Composition Contacts • Anodes • Electrodes • Brazing Blocks • Bearings • Pipe • Welding Rods, Electrodes and Plates • Packing, Piston, and Seal Rings • Rheostat Plates and Discs • Brake Lining, etc.

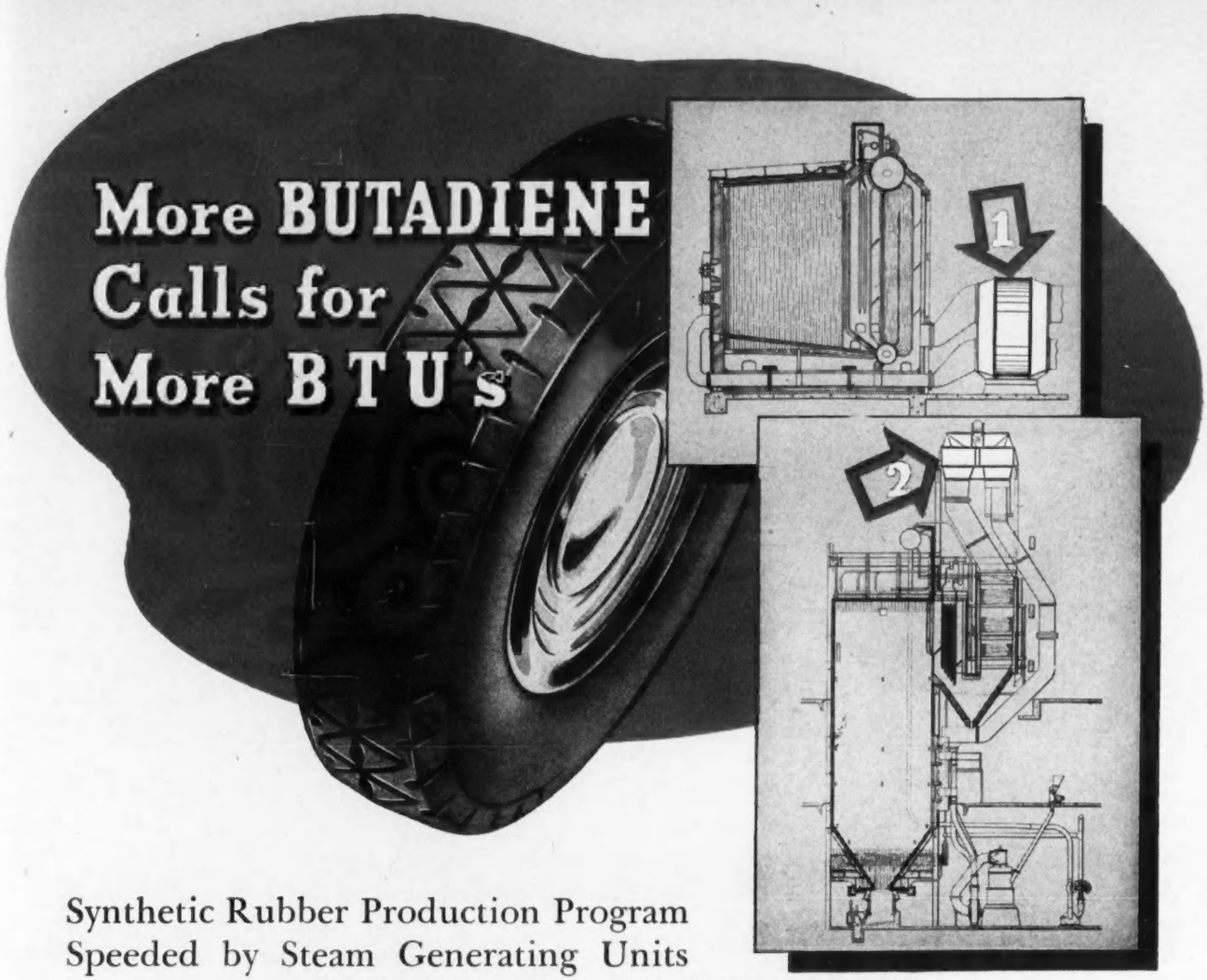
Stackpole Electronic Components

Fixed and Variable Resistors • Iron Cores • Switches

Stackpole brushes are made in carbon, carbon graphite, electro graphite, silver graphite, copper graphite, and in metal composition types for all rotating machines. Sold only to manufacturers of original equipment.

STACKPOLE

EVERYTHING IN CARBON BUT DIAMONDS



Synthetic Rubber Production Program Speeded by Steam Generating Units Equipped with LJUNGSTROM AIR PREHEATERS

Two typical steam generating units designed for refineries which are making butadiene are illustrated above, each equipped with a Ljungstrom Air Preheater. Furnace No. 1 has a capacity of 300,000 lb. of steam per hr. Gases enter the preheater at 735 deg. F., leave at 380 deg., heating the combustion air to 532 deg. In No. 2 furnace, capacity of 350,000 lb. per hr., gases enter the preheater at 700 deg. F., leave at 390 deg., heating combustion air to 550 deg.

• • •

The report of the Baruch Rubber Survey Committee highlights the call for more butadiene . . . the key factor in the production plan for some 370,000 tons of Buna S synthetic rubber.

But back of the need for more butadiene is a need for more process steam. New boiler plant capacity has to be added in a hurry, yet with the greatest possible conservation of steel.

Significantly, almost all of the power plants for this purpose now built or building are equipped with Ljungstrom Air Preheaters, despite a wide variation in other details of design. In addition, Ljungstroms are being used on the separately fired superheaters, and on the petroleum refining furnaces which help to supply the raw material.

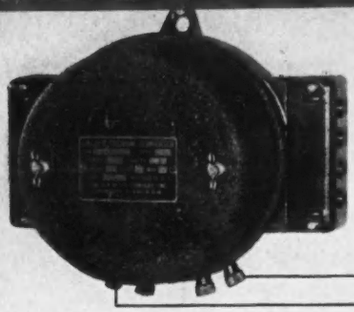
Using a continuous regenerative counterflow principle, Ljungstrom Air Preheaters give the maximum transfer of heat from flue gas to combustion air with the minimum of equipment weight and size. In installation, they save steel and save time. In operation, they save fuel and contribute to continuity of service. For information on their application to any gas-to-air heat transfer problem, write:

THE

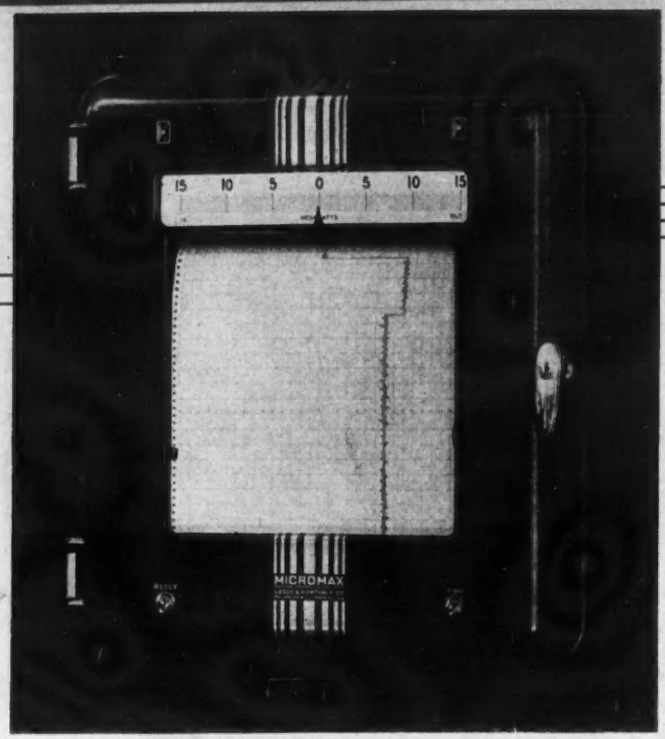
AIR PREHEATER

CORPORATION

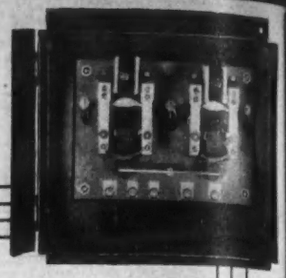
Executive Offices: 60 East 42nd Street, New York, N. Y. • Plant: Wellsville, New York



Lincoln Thermal Converter. Detects value of load and reports it to Micromax Controller.



Micromax Recording Controller for tie-line load. Measures tie-line load, and sends correcting impulses to governor-motor contactors when actual load differs from scheduled load.



Governor Motor Contactors.

Unit-Selector Switch Enables operator to assign tie-line control to any generating unit.

TIED IN WITH A UTILITY?
Here's the Tie-Line Control You'll Need

Industrial power plants which are tied in with a public-utility or other power network much larger than themselves can use the Micromax Tie-Line Load Controller to maintain, automatically, any desired interchange of load, and also to record the amount of power which changes hands. No alterations in the generator-governor are required; the Micromax Load Recorder simply operates the synchronizing motor on the governor, just as a man would do. In addition to being continuous and fully automatic, however, the mechanism detects and acts on load changes while they are still too small to show on a wattmeter, and so the Controller brings a new order of precision to the job of load-regulation.

This Controller is, mechanically, a standard Micromax, like those employed for temperature, frequency, voltage, salinity and many other conditions. Its load detector, the Lincoln Thermal Converter, is also a standard device on public-utility systems; it has no moving parts and requires no maintenance. The whole equipment can be installed by an electrician or instrument man.

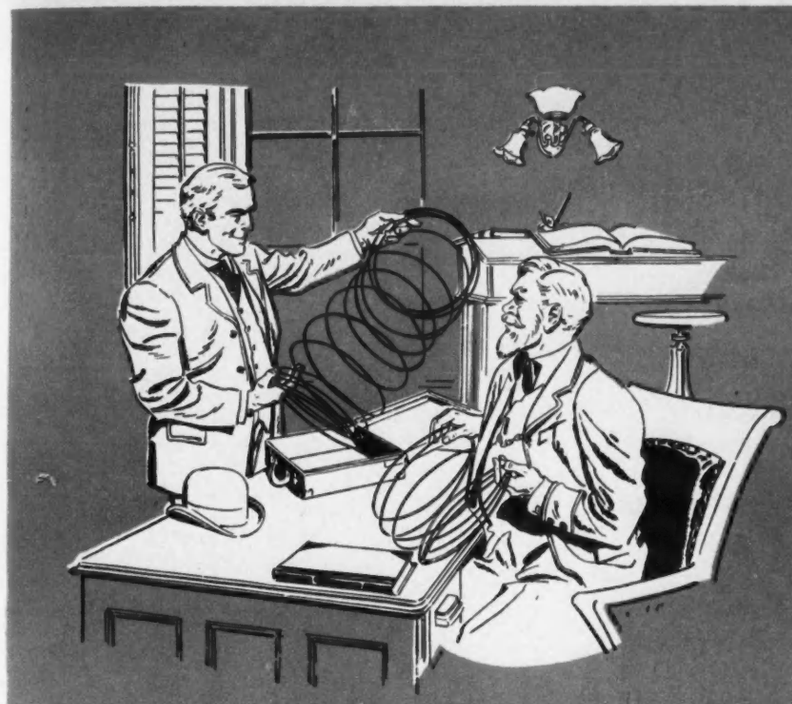
If you have a tie-line load problem on which this Controller could apply, outline it and we will send further information.

Jrl Ad N-56-161(3)

LEEDS & NORTHRUP COMPANY, 4938 STENTON AVE., PHILA., PA.

LEEDS & NORTHRUP

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES



Other traditions may well be challenged

Alcoa departed from tradition when they first introduced Aluminum as a conductor material to the electrical industry. Imagineering at work, forty-odd years ago, visualized a new, high conductivity, lightweight, corrosion-resistant conductor material. Then they engineered it into reality; first all-Aluminum, then A.C.S.R.

A million miles of Aluminum Cable Steel Reinforced, in service on hi-lines and rural lines all over America, long ago proved the sound thinking of those early Imagineers. Aluminum bus conductors, in the form of flat bars, tubing and channels, have also proved their worth in central stations, substations and industrial plant distribution systems.

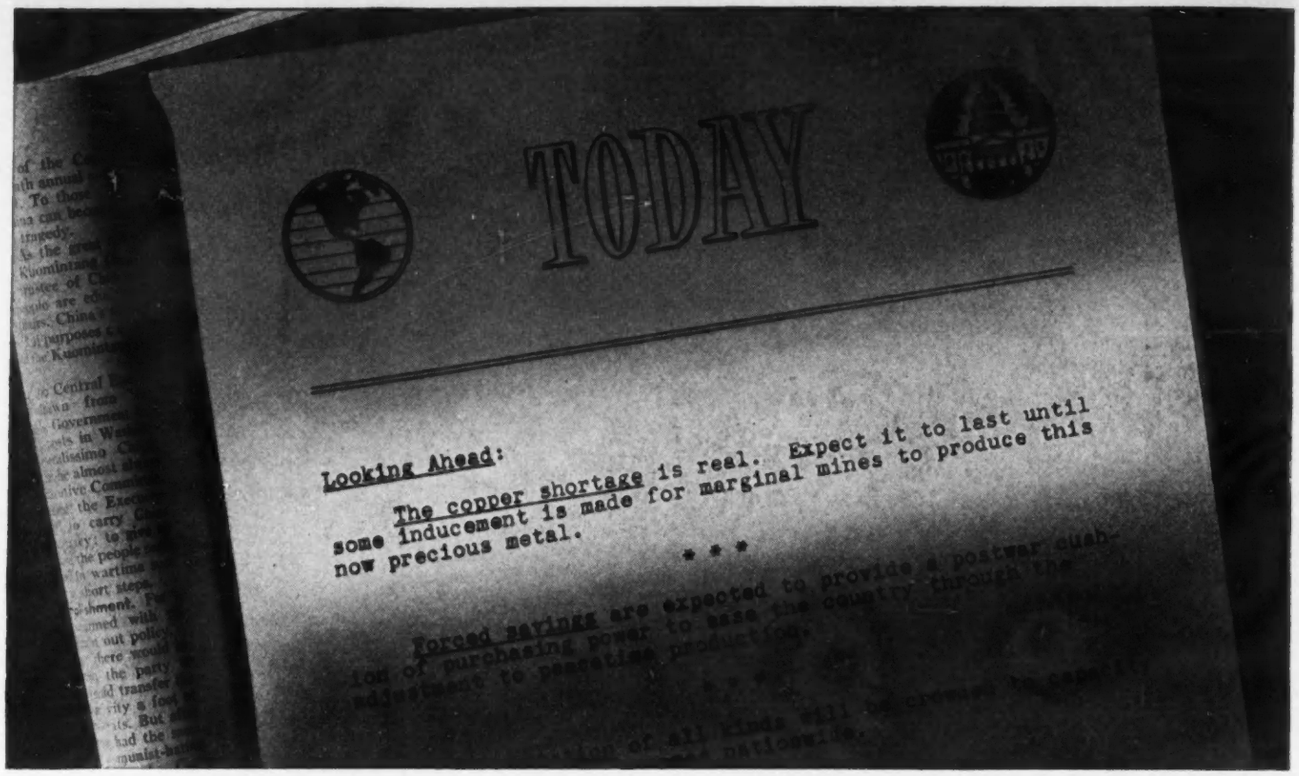
Today, new concepts of Aluminum arise from the swift technological advances resulting from the war effort and the greatly increased Aluminum production. New joining methods, new fabricating procedures, new alloys, new commercial forms, all combine to provide new economies and to broaden post-war applications of Aluminum.

Many of these new applications will be electrical. Versatile Aluminum will become an even more important tool in the hands of the electrical engineer. We'll gladly discuss the economic aspects of Aluminum with you as they apply to your design problems. ALUMINUM COMPANY OF AMERICA, 2138 Gulf Building, Pittsburgh, Pennsylvania.

IMAGINEERING AT WORK

ALCOA A·C·S·R

ALUMINUM CABLE STEEL REINFORCED


TODAY
Looking Ahead:
The copper shortage is real. Expect it to last until some inducement is made for marginal mines to produce this now precious metal.
* * *
Forced savings are expected to provide a postwar cushion of purchasing power to ease the country through the

GOULD PLANTE'S new type connectors deliver full current load for control and emergency lighting operations

RATED CONSERVATIVELY—Goulds will *equal or exceed* in capacity any battery of comparable size and cell structure. Buy on proven performance and you will buy Gould!

YES, COPPER IS SCARCE—but that's a problem that Gould engineers have licked. The connectors on the Gould Plante you buy today consist of lead of heavy cross section which delivers the same high voltage and performance as copper. Admittedly not as desirable as pure copper—the important thing is, they do the job. If you need a new battery, don't let the copper shortage stop you.

But first make sure you are getting the most out of your present Gould Plante. The exclusive Gould method of forming spun plates of pure lead permits the full capacity of the plates to be used—which means that Gould Plante will deliver, not years, but decades of service.

FREE HELP ON BATTERY PROBLEMS — Your Gould Service Man will help you get full service from your present equipment, regardless of make. No charge, no obligation. Write Gould Storage Battery Corp., Depew, N. Y. Ask for FREE descriptive literature on any type of industrial installation.

GOULD THE BATTERY PICKED BY ENGINEERS

Tomorrow may be too late—do it NOW

THIS

MIGHT HAVE PREVENTED

THIS

WARTIME restrictions make copper products hard to get — this includes electrical wire and cable. It will pay you to protect what you have.

Anaconda's Preventive Maintenance Plan will help you check to see that cables in your plant are not being abused.

If you follow this free plan you not only help yourself, but more important, you help the war effort. This manual provides a practical automatic method for complete analysis of circuits and equipment... uncovers potential weaknesses ... methods for correcting them ... with charts to enable quick periodic check-ups.

NOTE: Through this Preventive Maintenance Plan you may uncover the evidence necessary to obtain an "emergency repair priority." This is explained fully in the plan book.

ANACONDA'S PREVENTIVE MAINTENANCE PLAN

ANACONDA

Anaconda Wire & Cable Company
25 Broadway, New York City

Please send copy of the Anaconda Preventive Maintenance Plan for safeguarding production.

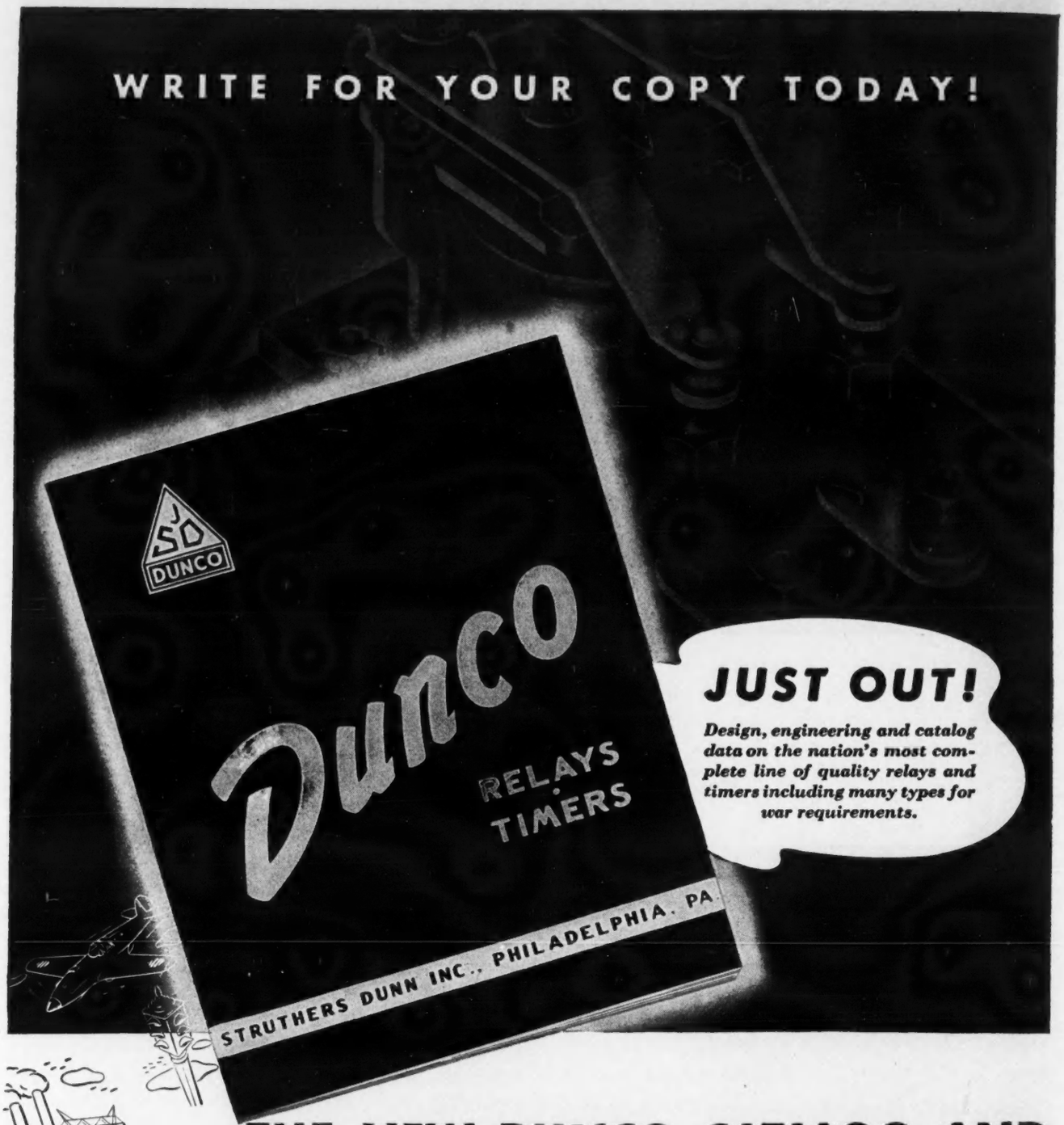
Individual .....

Company .....

Address ..... City .....

IL

WRITE FOR YOUR COPY TODAY!



JUST OUT!

Design, engineering and catalog data on the nation's most complete line of quality relays and timers including many types for war requirements.

THE NEW DUNCO CATALOG AND RELAY-TIMER DATA BOOK

• Far more than a catalog, the new Dunco Relay-Timer Book is a complete guide to relay selection and usage. Fully revised, greatly enlarged, profusely illustrated, replete with detailed specifications and engineering information, and prepared with a particular eye to war equipment requirements, it is a book that should prove helpful to designers, engineers, purchasing agents, production executives and maintenance men alike.

Write for your copy today—or as many copies as may be required to equip your organization. Please mention company connection.

STRUTHERS DUNN, INC., 1321 ARCH STREET, PHILADELPHIA, PA.

TO ALL EMPLOYES . . . . . .

We are engaged 100% in war work. In modern war proper communication between the various units engaged in combat is most important. We are manufacturing important items that are used in field communication, in airplane communication, in emergency field lighting, welding cables for the building of ships, tanks and other vital weapons of war. Our wires go into the building of camps and munition plants, and are an integral part of special tools. We also furnish many kinds of cables for railroads, utility services and mines. In other words, the products that you make play an important part wherever electricity, power, lighting and communication are necessary in this war. We have had letters from five of our boys in the service telling about using Rome Cable in the field.

Your work is very important in providing essential supplies to the boys and men in active service who are at grips with the enemy on various fronts. We count upon you to do your part.

"Rome Cable Quality Is In Your Hands"

Sincerely,

H. J. Tyett

President

October 1st, 1942

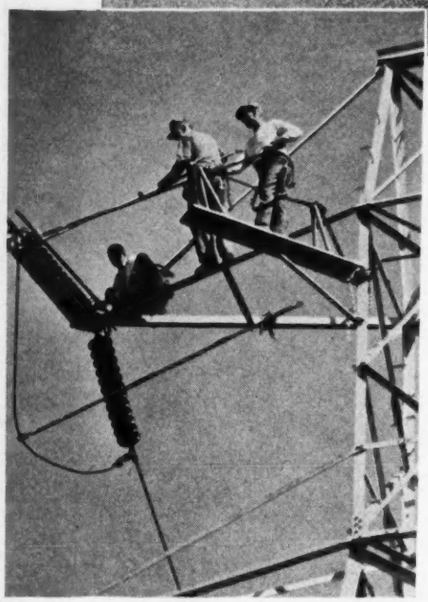
The Modern Kearney Live Line Tool Trailer

Maintain Urgent Service—Safely Using Kearney LIVE LINE TOOLS

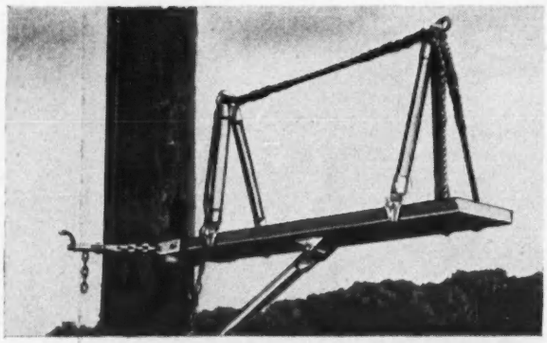
IT'S IMPORTANT to make repairs — replace insulators, change crossarms or poles, tap extensions leading to Defense and other plants—without interruption to service . . . And today, it is important to have the right Kearney Live Line Tools to do necessary jobs quickly, efficiently and safely.

Shown on these pages are some of the Kearney Live Line Tools and Accessories which are now being used to maintain urgent service and eliminate interruptions and costly shutdowns. And remember — the Kearney Corporation has skilled live line tool specialists who demonstrate the use of these tools on all sorts of important jobs.

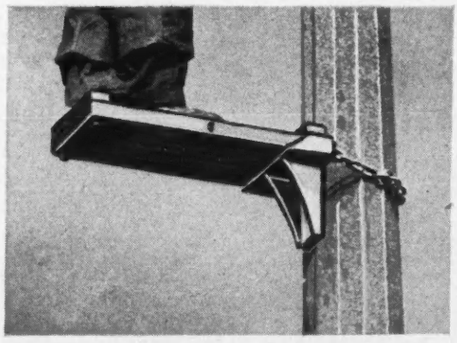
To arrange a demonstration for your crews, without obligation, speak to a Kearney Representative or write in today to the Live Line Tool Division of the James R. Kearney Corporation in St. Louis.



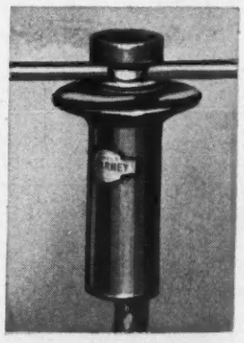
KEARNEY DEAD END TOOLS may be used on towers and on other constructions. This dead end tool has been especially designed to handle up to nine units on a string.



KEARNEY HEAVY DUTY PLATFORMS are recommended for heavier types of work. Boards of these platforms are treated and tested Douglas Fir and can be had with non-skid rubber mats. Safety Stagings are available at nominal cost. The staging ridge rope provides a safe place to attach a lineman's belt, in working position.

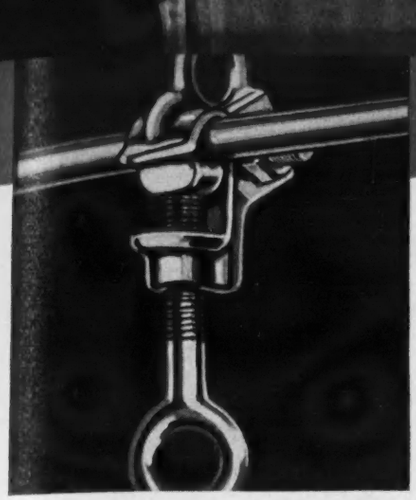


KEARNEY UTILITY PLATFORMS may be attached to iron, concrete or wood poles. They are available in two different sizes. One has a 24-inch board, the other a 30-inch board. The catalog number of the 24-inch board is No. 4905. The 30-inch board is catalog No. 4905-1.

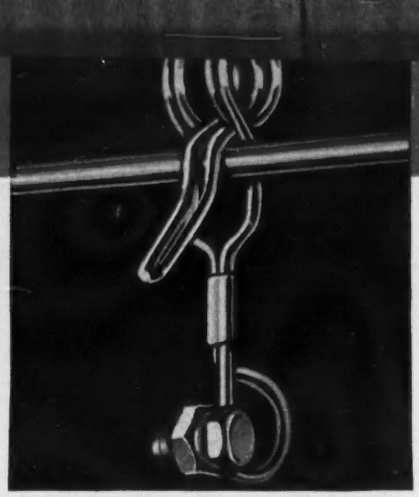


KEARNEY JUMPER CLAMPS, for maintenance, repair and construction work. Safely used wherever rubber gloves are being used.

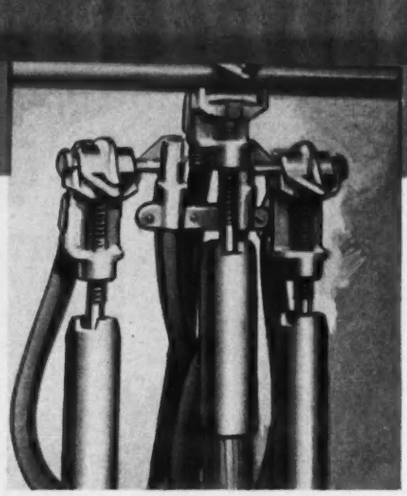
FOR BETTER MAINTENANCE and CONSTRUCTION — *Use* KEARNEY



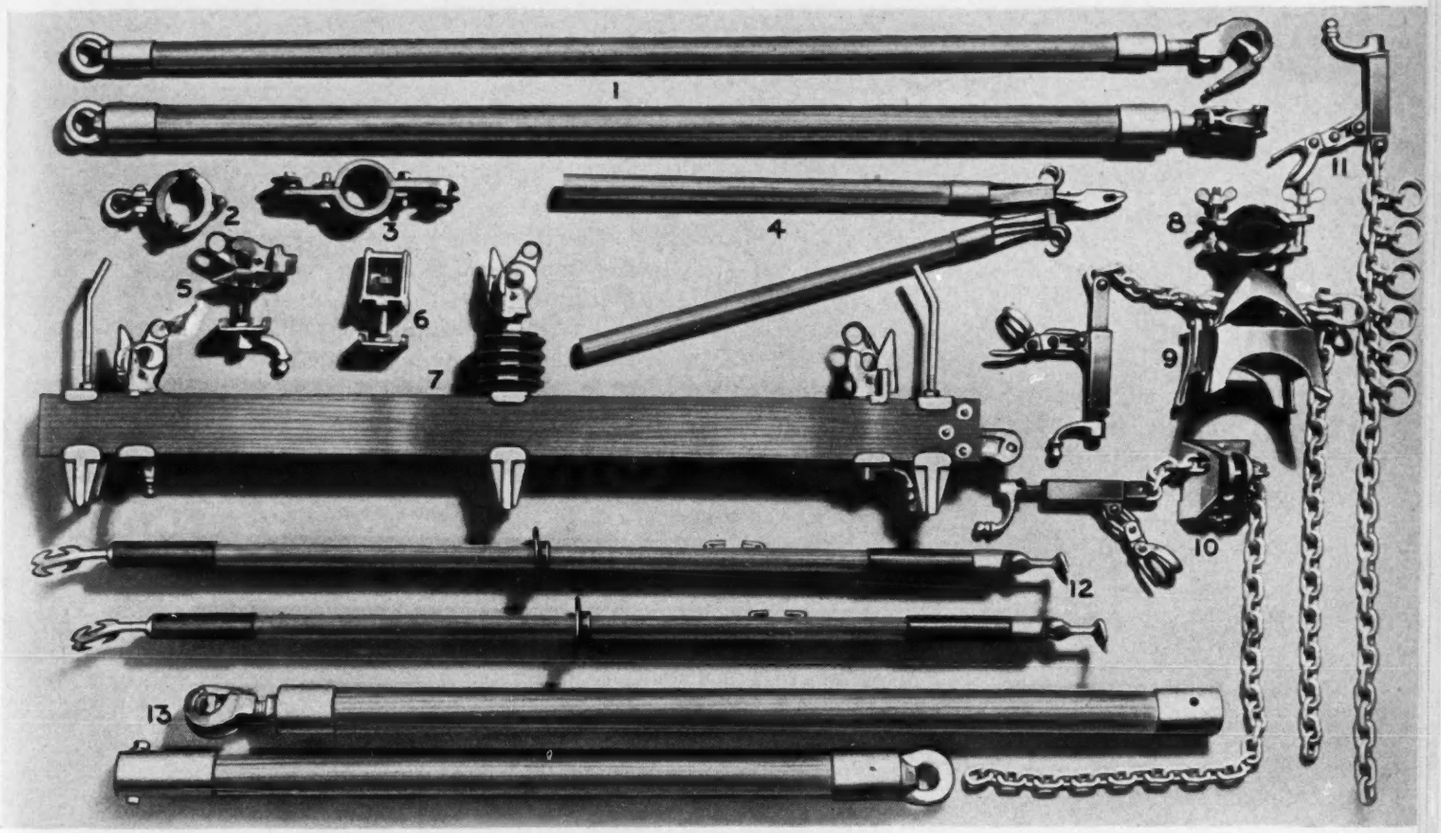
KEARNEY SERIES No. 3517 Con-Nec-Tap Clamps incorporate the principle of straight line pressure, from screw to line conductor to provide positive connections.



KEARNEY SPRING-TYPE CLAMPS, tap small transformers or arresters. With 70 amp. load, they show maximum temperature rise of 29° C., after two hours.



KEARNEY GROUND CLUSTERS, three-clamp sets, mounted or eye-screw type, provide convenience and safety in the handling of tower and pole line grounding.



THE KEARNEY TOOL SET

1. HAN-POLS are used in conjunction with Lift-Pols to manipulate live conductors; made of laminated spruce.

2. POL-BANDS are attachments for Lift-Pols which permit the use of rope blocks. Used in removing or returning conductors to or from the structure.

3. BRACE BRACKETS are mounted onto Lift-Pols to afford an attachment for the braces under the side arm when the assembly is used to simultaneously lift all conductors.

4. INSULATED PLIERS OR CUTTERS are available on 1¼ and 1½ inch diameter laminated oak handles, tested to 75,000 volts per foot.

5. SAFETY CONDUCTOR HOLDERS are used on all Kearney Side Arms and Lifting Arms. They are equipped with automatic safety catches.

6. SIDE ARM ADAPTER used at ends of arms to handle side braces and at center of arms to hold Lift-Pols.

7. SIDE ARMS are used to temporarily hold conductors while repairs are made. Wood is tested to 75,000 volts per foot.

8. POL-GRIPS—guide and anchor Lift-Pols being used to handle live conductors.

9. POL-GRIP EXTENSION permit setting Pol-Grips farther away from the line pole so that Lift-Pols or Han-Pols may clear each other when both are being used in close quarters.

10. LIFT-POL SNUB permits anchoring butt of Lift-Pol to the line pole when working suspension insulators. Also used as the saddle attached to the line pole, providing a socket in which the hinged casting of the side arm is placed.

11. ROPE HITCH provides a "hitching" place for block or hand lines.

12. COMBINATION TIE STICK removes or installs tie wires. Blade-Type Sticks with Prong-Type Heads on lower end are shown.

13. LIFT-POLS are used for moving and supporting live conductors. Made of laminated spruce, 2, 2½ and 3 inch diameters, lengths up to 14 foot. Laminated oak supplied on request. Splices are available for any size Lift-Pol.

PRODUCTS-

JAMES R. KEARNEY CORPORATION
4236 CLAYTON AVE. - ST. LOUIS, MO.
Canadian Plant • Toronto, Canada

Important Announcement!

Effective January 1, 1943, the name of Scully Steel Products Company was changed to United States Steel Supply Company

Scully... for many years a member of the family of United States Steel Subsidiaries — now takes a name which more fully represents its ability to serve you with a comprehensive list of steels and steel products.

Only the name has been changed. The same personnel in our eight conveniently located warehouses will continue to do their best to take care of your needs.

The prompt and courteous service that has made the name "Scully" famous will be maintained.

The addresses and phone numbers of our warehouses remain the same.

As always, we stand ready to give our customers every help we can in getting the right steel as promptly as possible.

UNITED STATES STEEL SUPPLY COMPANY

Distributors of Steel and Steel Products

CHICAGO
BRunswick 2000
Teletype CG. 605

BOSTON
STAdium 9400
Teletype BRTN 10

CLEVELAND
HEnderson 5750
Teletype CV 153

ST. PAUL-MINNEAPOLIS
NEstor 2821
Teletype STP 154

PITTSBURGH
CEdar 7780
Teletype PG 475

BALTIMORE
GILmore 3100

ST. LOUIS
MAin 5235

NEWARK, N. J.
BIgelow 3-5920—BErgen 3-1614—REctor 2-6560
Teletype NK 74

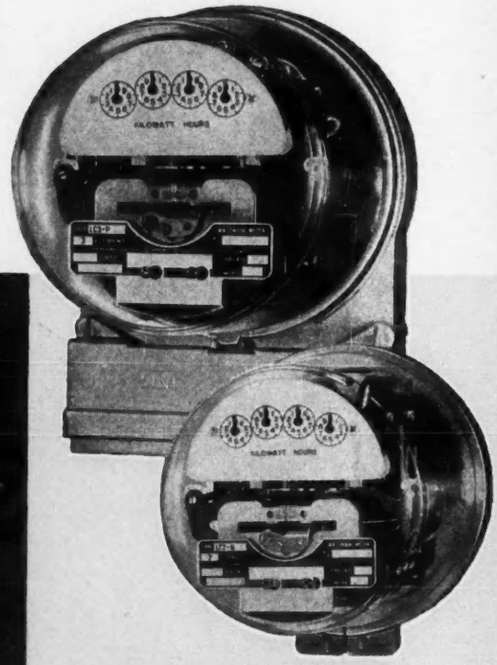
USS

UNITED STATES STEEL

WAR BONDS MAKE
UNCLE SAM MORE
POWER-*full*

"On Measurement is founded the whole progress of man.."

One foot equals twelve inches, but the inch was not definite enough for King Edward II of England. So, with great pomp and acclaim, in 1324 he decreed that, "three barley corns, placed end to end, shall equal one inch." Since he was King and Lord of everything he surveyed, his word settled everything. Or did it? Despite his power over men, the foot continued to vary from 9¾ to 19 present day inches. That was the conception of standardization. Compare it with today's high standard of measurement of electricity set and met by the electric utilities and the manufacturers of watthour meters.



NO OTHER COMMODITY IS MEASURED SO *Accurately* AS ELECTRIC POWER

SANGAMO ELECTRIC COMPANY SPRINGFIELD ILLINOIS

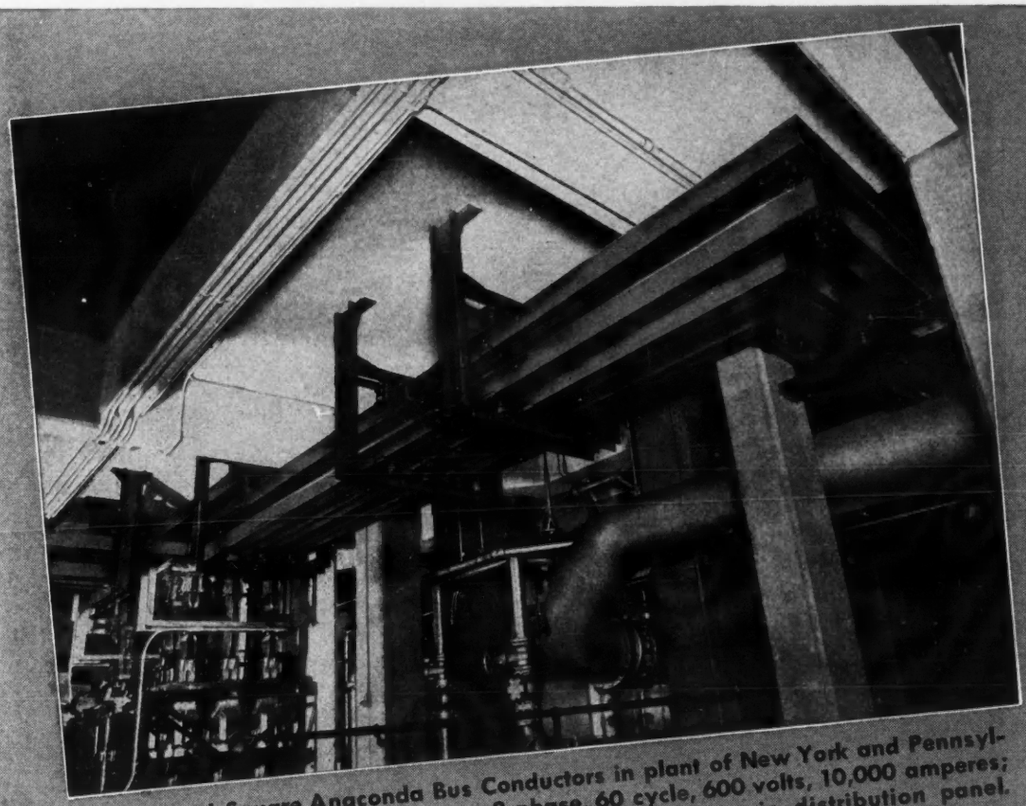
ANACONDA COPPER BUS CONDUCTORS

Because of its high conductivity and consequent low current losses, copper has always been the most widely used material for bus conductors.

To these advantages may be added such further qualifications as high thermal conductivity, high strength, high resistance to corrosion and ready availability of accessory equipment. It is for these reasons that copper lends itself to more efficient bus constructions.

Wherever modern electrical engineering practice dictates bus construction embodying structural strength, low ohmic and reactance losses or effective heat dissipation, the range of copper bus shapes made by The American Brass Company will meet every requirement, for, in addition to a complete line of copper bus bars of rectangular shapes, this Company makes high conductivity pipe and tube, stranded cables and special shapes.

Of particular interest to electrical engineers are the hollow ventilated busses made from channels, angles and rectangular copper bars. Technical information, including the suggestions of our Engineering Department on various bus conductors and assemblies, is available on request. 4299



6" Channel-Square Anaconda Bus Conductors in plant of New York and Pennsylvania Co., Inc., Lock Haven, Penna. 3 phase, 60 cycle, 600 volts, 10,000 amperes; connecting turbo-generator to circuit breakers and main distribution panel.

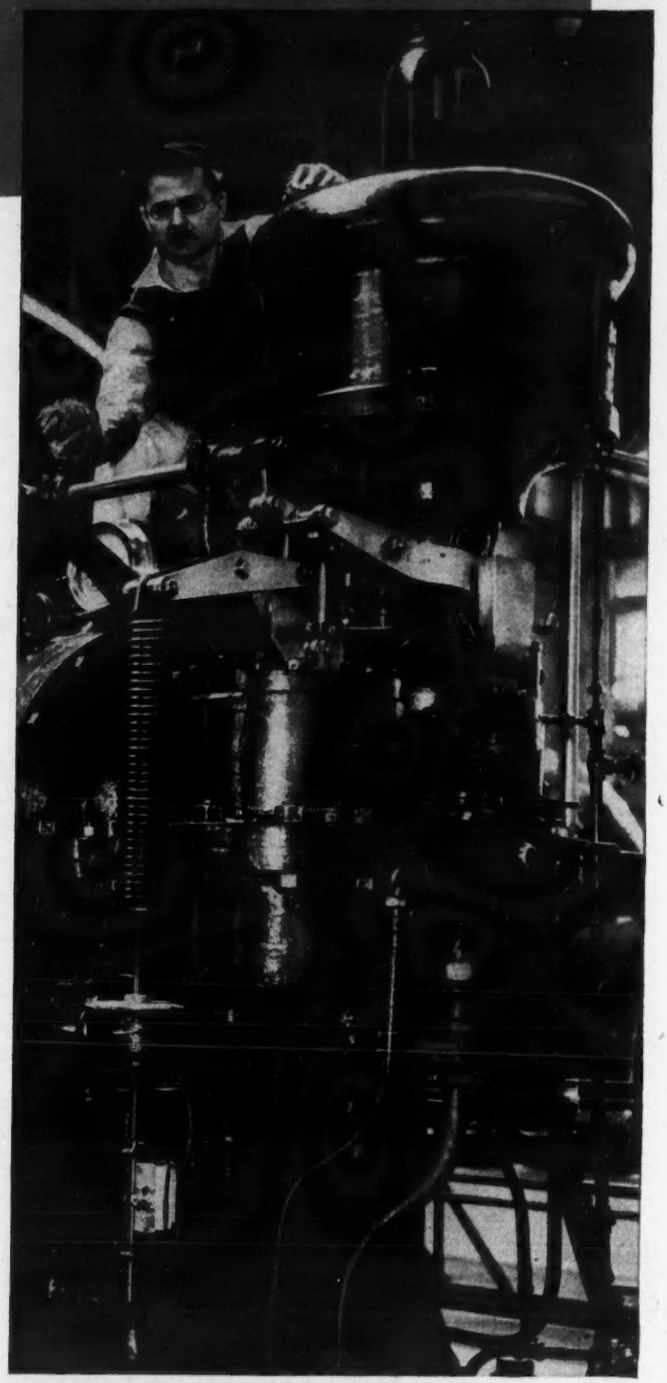
Anaconda Copper

THE AMERICAN BRASS COMPANY • GENERAL OFFICES: WATERBURY, CONN.

Subsidiary of Anaconda Copper Mining Company • In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ontario*

Sensitive Governor Action

UNDER WARTIME LOADS



BIG AIDS in maintaining system stability under wartime loads, are turbine governors which are instantly responsive to sudden load swings. You can assure your governors of this continued, maximum sensitivity . . . by using *Texaco Regal Oils.*

Regal Oils rapidly free themselves from air and water, stubbornly resist oxidation, emulsification, gum and sludge formation. They keep lubricating systems clean, governors responsive, bearing temperatures normal.

The outstanding performance that has made Texaco preferred in the fields listed in the panel has made it preferred by prominent turbine operators everywhere.

These Texaco users enjoy many benefits that can also be yours. A Texaco Lubrication Engineer will gladly cooperate . . . just phone the nearest of more than 2300 Texaco distributing points in the 48 States, or write:

The Texas Company, 135 E. 42d St., N. Y., N. Y.

THEY PREFER TEXACO

★ More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

★ More locomotives and cars in the U. S. are lubricated with Texaco than with any other brand.

★ More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

★ More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.

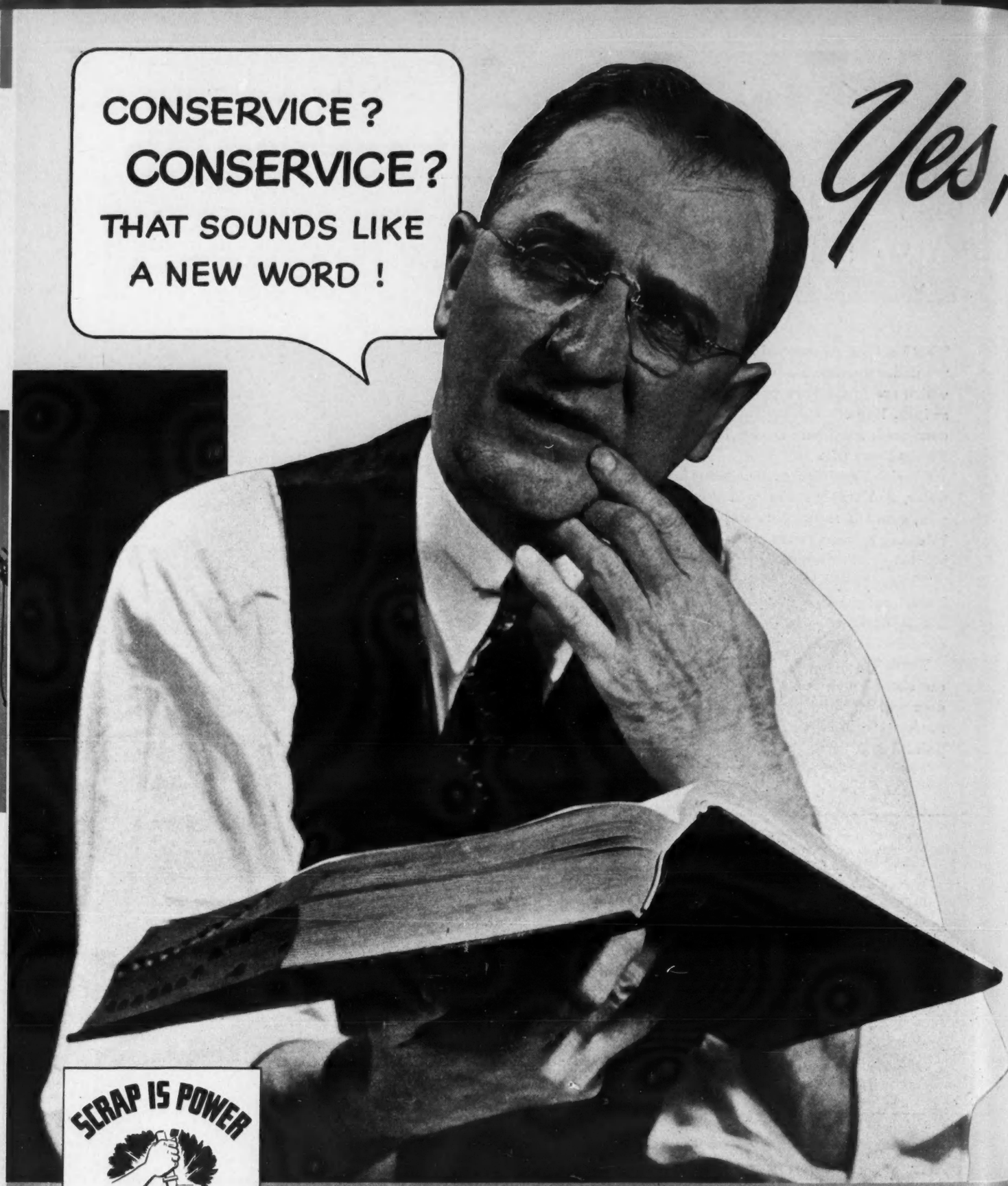
TEXACO

REG. T.M.

TEXACO Lubricants

FOR ALL TURBINES

TUNE IN FRED ALLEN EVERY SUNDAY NIGHT—CBS ★ HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY



SCRAP IS POWER

you help.. THE WAR EFFORT
.. YOUR CUSTOMERS AND YOURSELF

... when you salvage, in accordance with your manufacturer's instructions, all inoperative parts containing...

CRITICAL MATERIALS

Cooperate with Your Industry!
Put Vitally Needed Scrap Back Into The Scrap

today!

Westinghouse

"CONSERVICE" IS A NEW WORD!

It sums up the broadened conservation and service program now being operated by Westinghouse and its retailers

Conservation . . . Service . . . these two critical words have been telescoped into *Conservice*—a new term for a new kind of helpfulness to appliance users.

Here is what this Conservice program is designed to do:

1. Educate your customers in the proper "care and use" and thus—
   . . lengthen the life of appliances
   . . prevent needless service calls
2. Promote conservation of renewal parts—
   . . by showing your servicemen how to repair old parts
   . . by reoperating at the factory the used parts which you return, thus conserving critical materials
3. Help you provide quality service—
   . . by informing and training your servicemen
   . . by providing renewal parts

In order that your entire service department, especially the newcomers, shall be primed on every phase of this new Conservice program, Westinghouse is launching a series of Conservice Training Schools. Both in scope and character, we believe they will go far beyond anything ever before offered by a manufacturer of electric appliances.

While doing everything in our power to keep a steady supply of renewal parts flowing to you, we are at the same time giving you the kind of practical assistance that will help you solve your man power and service problems.

WESTINGHOUSE ELECTRIC APPLIANCE DIVISION
MANSFIELD, OHIO

Coming your way!

A COMPLETELY EQUIPPED CONSERVICE TRAINING SCHOOL

Hundreds to be conducted during 1943

Here's a course of instruction made to order for the times. One part of it is planned especially for the newer men and women who will be servicing appliances during the coming months.

With dramatic films, illustrated manuals, simple discussions and demonstrations, the service person receives training completely covering the servicing of Westinghouse appliances and the conservation of renewal parts.

Your Westinghouse distributor will notify you as soon as the date is set for the Conservice Training School in your territory.

Copyright 1943,
Westinghouse Electric & Mfg. Co.

Tune in John Charles Thomas, Westinghouse Radio Program, NBC, Sunday 2:30 P.M., Eastern War Time

WESTINGHOUSE

Electric Home Appliances

NEW "Rub-Less" WIRE

NO RUBBER, NO SYNTHETIC, NO TIN

1 Transversely crumpled, moisture-resistant Kraft 2 Cellulose-acetate butyrate (Kodapak No. 2) insulation 3 No tin or alloy coated copper 4 "Dilec" cotton serving 5 Moisture-resistant, flame-retardant finish

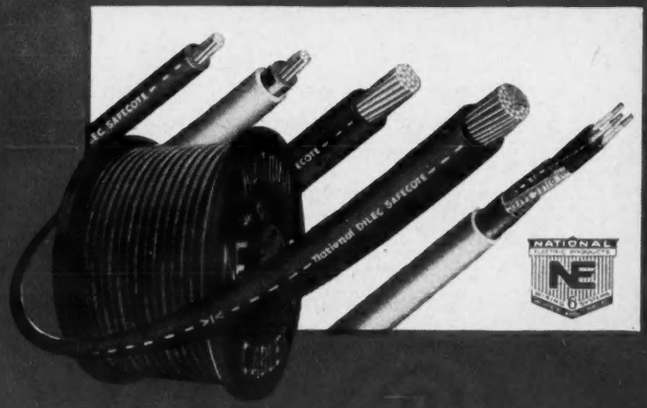
Made in all sizes, 14 to 1,000,000 CM, and in standard colors —black, white, red, blue, green and yellow.

Lead covered "Rub-r-Less" Wire, Type "EIL" with standard wall thickness of lead, also CAA specification, lead covered, with 2 "Dilec" servings over the lead for underground work.

Approved by the Underwriters' Laboratories Inc. for use as a substitute for rubber insulated wire under conditions stated in Interim Amend. Nos. 44 and 69 covering Section 3005 of the N. E. Code.

Conforms to Department of Commerce CAA-612 Specification also Section 34 War Department Office of Chief Engineers Specification for Theater of Operations and Mobilization Construction. "Rub-r-Less" Wire is also included in suggested specifications to architects issued by Federal Works Agency, Public Building Administration.

Distributed through National Electric distributors throughout the United States.



National Electric
PRODUCTS CORPORATION
Pittsburgh, Pennsylvania

stronger

• In previous annual statistical issues, as we have reported the progress of the power industry while operating in a civilian economy, we have remarked on its general stability. This year, as we review the first full year of war and all the economic upheaval it brings, we are more than ever struck with the strength of an industry that not only withstood those shocks but at the end of the year was apparently stronger than at the beginning.

• Other industries have been torn from their moorings. Working in areas foreign to their normal operations, they swing with the tide of war demands. Electric power, on the other hand, while obviously undergoing many changes in the conduct and character of the business, shows on the whole little variation in the general economy of its operations. The year's bark was worse than its bite.

• Utilities not only experienced a smaller demand for electricity than some people in high position had predicted, but even ended the year with a larger reserve in generating capacity in the aggregate than they had in the previous December.

• The character of the load, of course, underwent a great change in many properties, but looking at the totals one sees a normal increase in residential consumption and but a little less than normal increase in small light and power, with very little variation in the relative position of the three major elements of utilization. The one place where the change was apparent was in the number of customers, where the mortality in commercial customers and small factories that were not able to convert was very evident.

• Even the cost of energy continued as usual in its downward path, not so rapidly perhaps, but nevertheless down. We wonder if there is any other industry that can match that.

• Taxes were expected to give a crippling blow to utilities, and there is no denying that they were plenty big, but much of their sting was removed by the ability of management to hold down over-all operating expenses to approximately the same ratio as the year before.

• While it would be unwise to try to predict the situation twelve months hence, it is safe to say that the utilities can face 1943 with much less apprehension on the operating side than a year ago. The start is good; the finish might well be better.

Summary Statement of

OUTSTANDING FACTS

	1932	1936	1937	1938	1939	1940	1941	1942
FIXED CAPITAL ($1,000)	12,664,377	.....	12,940,993	.....	.....	.....	14,143,000	.....
Securities issued [1]	470,257	1,331,940	646,312	964,005	996,347	989,459	740,832	351,554
News capital	165,728	59,727	81,984	123,056	16,219	92,376	97,065	92,466
Refunding	239,112	1,272,213	563,699	840,949	980,128	897,083	643,767	259,088
REVENUE [2] ($1,000)								
From ult. consuners	1,813,717	2,044,587	2,160,798	2,156,580	2,289,583	2,440,218	2,665,057	2,853,000
Rural	47,128	59,286	37,726	38,928	45,484	49,473	64,396	75,500
Residential	640,385	696,997	759,824	802,532	843,158	895,951	938,229	991,800
Small light and power	500,993	562,122	616,438	632,091	660,683	689,253	725,117	771,800
Large power and light	474,425	581,149	583,197	518,694	572,659	631,428	758,083	823,100
Other consumers	150,786	145,032	163,611	164,334	167,597	173,752	179,233	190,800
EXPENDITURES ($1,000)								
Capital	285,000	289,710	455,480	482,000	430,000	596,580	654,148	**270,823
Operating, total	817,950	.....	1,027,588	.....	.....	.....	.....	.....
Salaries and wages	323,880	360,000	470,353	460,000	469,500	488,000	537,000	510,000
PRIVATE COMPANIES ($1,000)								
Operating revenue	1,713,000	1,911,000	2,031,000	2,018,000	2,148,000	2,277,000	2,475,000	2,630,000
Operating expenses	618,000	721,000	781,000	762,000	798,000	863,000	950,000	1,015,000
Taxes	201,000	281,000	308,000	323,000	352,000	404,000	521,000	635,000
OUTPUT [3] (1,000,000 kw.-hr.)								
Generated	82,377	112,181	121,837	116,681	130,336	144,985	168,170	188,500
From steam	48,457	71,756	76,330	70,727	85,007	95,675	115,276	123,500
From water power	33,322	39,516	44,489	44,834	44,021	47,753	51,262	63,200
From internal combustion	598	909	1,018	1,120	1,307	1,557	1,632	1,800
CAPACITY [3] (1,000 kw.)								
Generator ratings	35,991	36,564	37,134	39,042	40,318	41,639	44,092	46,812
Steam	25,474	25,519	25,873	27,203	28,047	29,019	30,823	32,479
Hydro	9,583	10,436	10,576	11,066	11,415	11,675	12,264	13,274
Internal combustion	487	609	685	773	856	945	1,005	1,059
FUEL CONSUMPTION [3]								
Coal and coke (1,000 short tons)	30,296	42,025	44,766	40,212	46,223	53,398	64,760	68,140
Oil (1,000 bbl.)	7,967	14,119	14,143	13,077	17,423	16,722	20,250	16,600
Gas (billion cu. ft.)	108	156	171	171	191	183	205	229
ENERGY SALES [2] (1,000,000 kw.-hr.)								
Ult. consumers	63,711	90,044	99,359	93,731	105,768	118,643	140,060	158,800
Rural	1,579	2,138	1,670	1,577	1,881	1,991	2,352	2,900
Residential	11,494	14,992	17,691	19,371	21,084	23,318	25,124	27,000
Small light and power	12,106	15,612	18,075	19,137	20,722	22,373	24,628	27,350
Large power and light	30,964	48,655	51,360	43,140	51,108	59,557	76,060	88,000
Other	7,568	8,647	10,562	10,505	10,972	11,405	11,896	13,550
CUSTOMERS [2] (1,000)								
Total number	23,878	26,206	27,262	28,064	29,105	30,191	31,607	32,216
Rural	709	1,043	519	526	634	686	987	1,103
Residential	19,140	20,988	22,372	23,112	23,965	24,952	26,025	26,616
Small light and power	3,604	3,825	4,072	4,127	4,215	4,260	4,300	4,224
Large power and light	371	280	197	192	184	178	173	149
Other	54	70	102	107	106	115	122	124
People in electric lighted homes	81,380,900	90,327,100	93,853,100	96,915,800	100,855,900	97,424,400	102,695,600	105,332,200
Per cent of total population	65.4	70.7	73.1	74.9	77.3	74.0	78.0	80.3
EMPLOYEES, total	244,573	268,000	279,000	270,000	269,000	265,000	270,000	245,000

* Estimated, generally on ten months' operations. [1] Includes warrants and rights. [2] Revised figures beginning with 1937 conform to Uniform System of Accounts. [3] Includes other electric, in addition to light and power. ** Private utilities only.

Strong Under the War Load

HIGHLIGHTS

OUTPUT: 188.5 Billion Kw.-Hr.

Increase in 1942 less than in 1941, 12 and 16 percent. Hydro has biggest year, contributes 60 percent of increase over 1941. Output from government-owned plants rises to 14 percent of total.

CAPACITY: 46.8 Million Kw.

Up 6.1 percent, 2.7 million, over 1941. Reserves increased. Fuel capacity remains proportionately as large as in 1941. Increase in proportion of government-owned capacity, now 17 percent.

NEW CAPACITY: 2.7 Million Kw.

Scheduled future additions during war period total to nearly 4 million kw., of which 64 percent is fuel power.

CUSTOMERS: 32.2 Million

Increase of 1.9 percent markedly below 1941. Drop of 100,000 in "Small Light and Power" evidences mortality in small business group. Customer shifts show population movements.

ENERGY SALES: 158.8 Billion Kw.-Hr.

Rate of increase of industrial power sales slower than in 1941. Residential sales continue to rise, go over 1,000 kw.-hr. per customer per year.

REVENUE: 2.85 Billion Dollars

Rises 7 percent over 1941. Average residential revenue per kw.-hr. continues down to 3.67 cents. Industrial customers contribute larger share to total than in any year since 1929.

OPERATING EXPENSES: 1 Billion Dollars

Operating ratio before taxes rises only 0.2 percent over 1941. Taxes now up to over 24 percent. Smaller shares for fixed charges, dividends and surplus.

BUDGET: 300 Million Dollars

1942 expenditures for generation and transmission little affected by war scarcities. Greatest burden of curtailment falls on distribution.

FINANCING: 352 Million Dollars

Less than half of 1941, but new capital addition remains about the same. Decrease is in refunding.

REA: 1.43 Billion Kw-Hr.

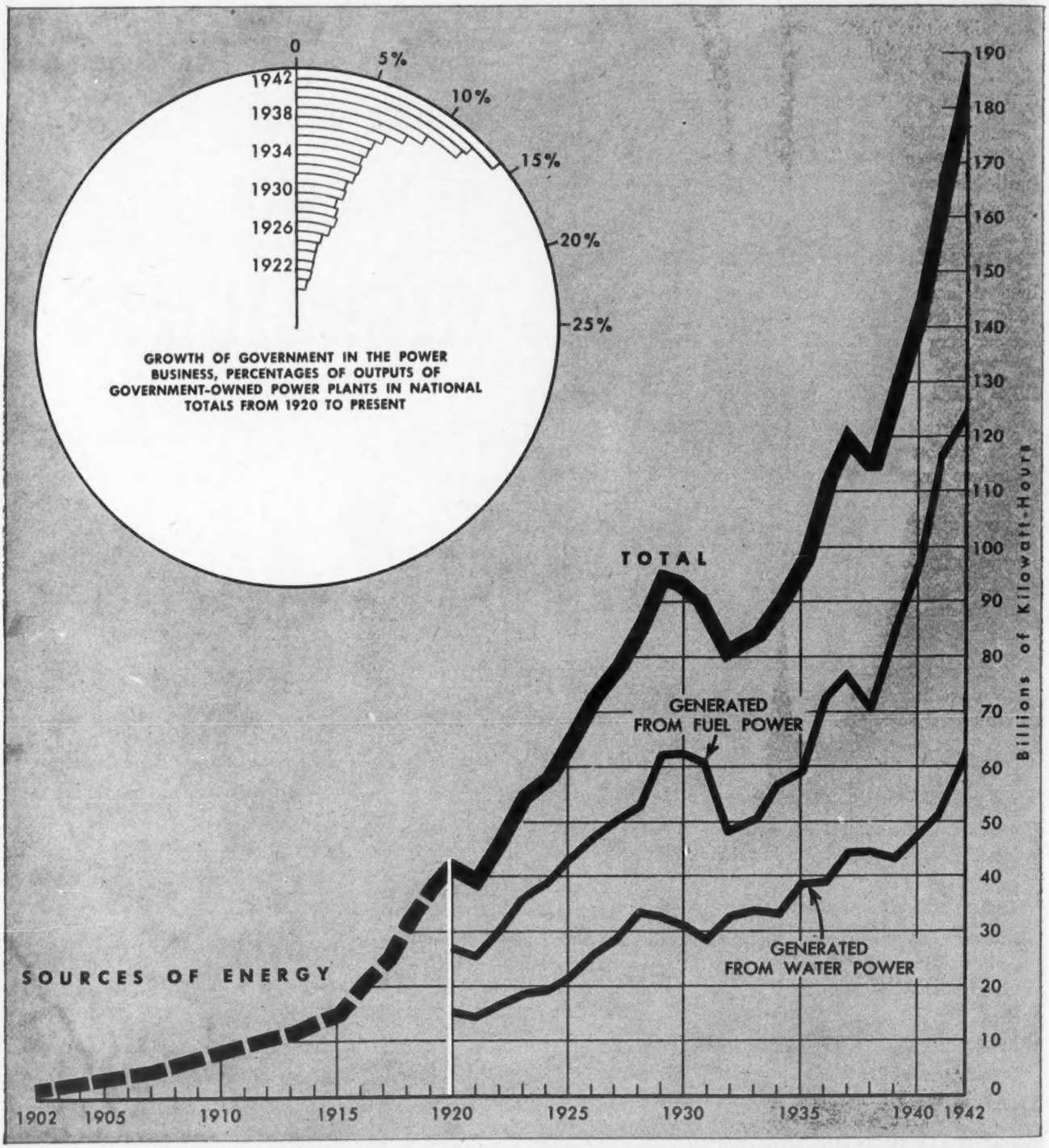
Radical changes in average quantities of sales, revenue and cost of energy result from connection of comparatively few large customers.

MANUFACTURING: 7 Billion Dollars

Production for war raises volume 50 percent over 1941. Appliance manufacture discontinued. Declining curve of new orders indicates slow-up coming.

188,500,000,000 Kw.-Hr. OUTPUT

Mere increase (20 billions) in kilowatt-hour output in the first full calendar year of global war for the United States was in itself practically equal to the entire national generation in the first year of the first World War. Nevertheless, despite this 12 percent increase in total generation for 1942, it was not as great proportionately or actually as the 16½ percent increase experienced in the preceding year. Practically 60 percent of the increase was contributed by hydro systems, which, however, furnished only a third of the total generation. It was no such year of scant



water as was 1941 and it was natural to relieve steam station capacities as much as possible.

Privately owned electric producers contributed 86 percent of the year's generation but only 70 percent of the increase, indicating the extent to which heavy consumption war loads have been taken on by governmentally owned plants—enough to raise their output ratio to a one-in-six level.

Regionally, the banner for percentage increase in output goes to the South Atlantic states for their 49.7 percent for hydro accompanied by only a 3.7 percent rise in steam generation. East South Central region is second. Conversely, the Pacific states stepped up steam 42 percent along with 18.2 percent additional hydro. In order of rank as to increases for the year the regions stand: S.A., Pac., Mtn., W.S.C., E.S.C., M.A., W.N.C., and N.E. The order in terms of contribution to the total national output stands: M.A., E.N.C., S.A., Pac., E.S.C., Mtn., N.E., W.N.C., W.S.C. Fuel generation decreased 1.2 percent in New England; coupled with 14.75 increase in hydro, the region experienced only a 2.77 percent over-all increase.

PRODUCTION OF ELECTRIC ENERGY BY OWNERSHIP

(In Millions of Kw.-Hr.)

Year	Privately Owned				Government Owned		
	Electric Utilities	Mining and Mfg.	Railways	Sub-total	Local†	Federal	Sub-total
1929	87,514	780	2,965	91,259	4,367	300	4,667
1930	86,108	790	2,750	89,648	4,538	465	5,003
1931	82,597	789	2,590	85,975	4,257	497	4,754
1932	74,488	596	2,388	77,472	4,460	445	4,905
1933	76,668	740	2,256	79,664	4,614	459	5,072
1934	82,079	1,193	2,355	85,627	4,822	357	5,179
1935	89,330	831	2,346	92,506	5,403	555	5,958
1936	102,293	667	2,198	105,159	5,950	1,072	7,023
1937	110,464	784	2,140	113,388	6,606	1,843	8,449
1938	104,090	857	2,012	106,959	6,693	3,029	9,722
1939	115,078	851	1,843	117,772	7,088	5,476	12,564
1940	125,411	908	1,323	127,642	8,758	8,584	17,342
1941	144,289	851	816	145,956	11,420	10,794	22,214
1942*	158,300	.....	.....	161,500	.....	.....	27,000

Source: Federal Power Commission. * Estimated. † Includes cooperatives.

SOURCE AND DISPOSAL OF ENERGY

(In Millions of Kw.-Hr.)

Year	Generated from		Total Generation	Add Imports from Canada	Less Energy Used by Producer	Total for Distribution	Losses	Sales to Ultimate Consumers
	Fuel Power	Water Power						
1929	62,734	33,191	95,925	962	6,610	90,277	14,983	75,294
1930	62,914	31,738	94,652	1,084	6,269	89,467	14,561	74,906
1931	61,149	29,580	90,729	794	5,459	86,064	14,162	71,902
1932	49,055	33,322	82,377	446	5,248	77,575	13,864	63,711
1933	50,678	34,058	84,736	613	4,910	80,439	14,523	65,916
1934	57,093	33,713	90,806	893	5,499	86,200	15,118	71,082
1935	59,430	39,034	98,464	901	5,669	93,696	16,100	77,596
1936	72,665	39,516	112,181	1,054	5,826	107,409	17,365	90,044
1937	77,348	44,489	121,837	1,733	6,428	117,142	17,783	99,359
1938	71,847	44,834	116,681	1,867	6,990	111,558	17,826	93,731
1939	86,314	44,022	130,336	1,900	7,734	124,502	18,735	105,768
1940	97,232	47,753	144,985	937	7,268	138,654	20,011	118,643
1941	116,908	51,262	168,170	927	6,335	162,762	22,702	140,060
1942*	125,300	63,200	188,500	1,500	6,000	184,000	25,200	158,800

Sources: Federal Power Commission and Edison Electric Institute. * Estimated.

ENERGY PRODUCTION BY REGIONS

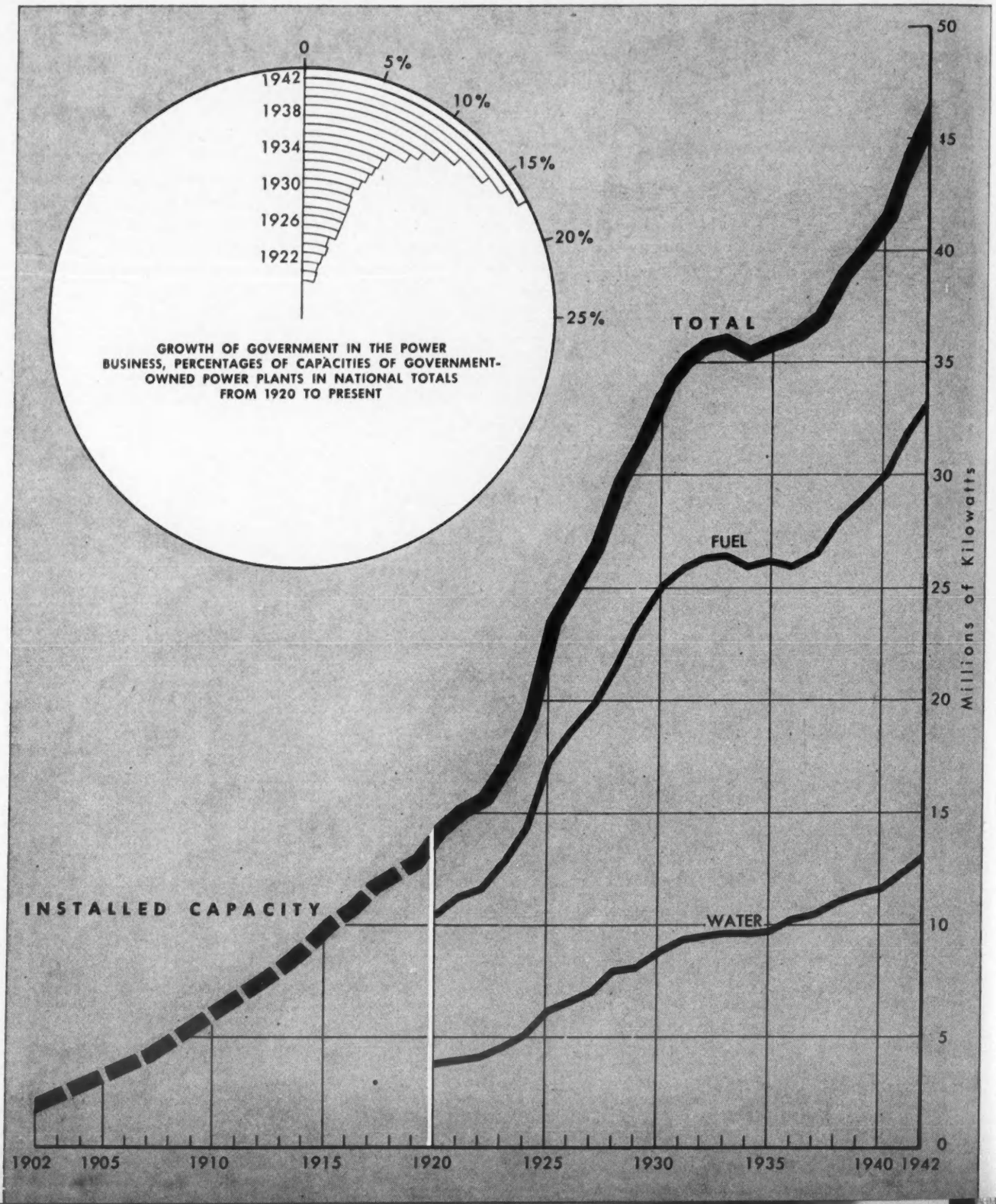
(In Millions of Kw.-Hr.)

Region	1939			1940			1941			1942*		
	Fuel Power	Water Power	Total	Fuel Power	Water Power	Total	Fuel Power	Water Power	Total	Fuel Power	Water Power	Total
N.E.	5,475	2,876	8,351	6,195	2,773	8,968	7,882	2,549	10,431	7,780	2,940	10,720
M.A.	25,635	7,335	32,970	28,662	7,721	36,383	34,029	7,283	41,312	35,660	9,390	45,050
E.N.C.	27,113	2,883	29,996	30,754	2,858	33,612	36,296	3,089	39,385	39,680	3,520	43,200
W.N.C.	5,994	1,865	7,859	6,787	1,694	8,481	7,240	2,732	9,972	7,660	2,940	10,600
S.A.	9,628	5,562	15,190	11,865	5,752	17,617	16,172	4,808	20,980	16,730	7,200	23,930
E.S.C.	1,911	5,057	6,968	2,413	6,058	8,471	3,914	6,172	10,086	4,400	8,300	12,700
W.S.C.	6,740	239	6,979	7,114	319	7,433	8,061	779	8,840	9,050	920	9,970
Mountain	1,476	6,017	7,493	1,774	6,770	8,544	1,546	7,713	9,259	1,830	8,900	10,730
Pacific	2,343	12,188	14,531	1,665	13,808	15,473	1,768	16,137	17,905	2,510	19,090	21,600
U.S.	86,314	44,022	130,336	97,232	47,753	144,985	116,908	51,262	168,170	125,300	63,200	188,500

Source: Federal Power Commission. * Estimated.

46,812,000 Kw. CAPACITY

During 1942 the public service electric systems of the nation increased their generating capacity by 6.65 percent to reach the new total of 46,812,000 kw. Of this amount hydro increased 8.15 percent to become 28.4 percent of the total, a new high, and fuel power rose 5.31 percent to constitute the 71.6 percent remainder. Focussing on contributions from the ownership angle, the privately owned utilities added 1,600,000 kw. and all government-owned (local and federal) 1,122,000 kw., the latter of course mostly all hydro. Every area but the West



INSTALLED CAPACITY

(In Thousands of Kw.)

Year	Type of Prime Mover		
	Fuel	Water	Total
1929	23,456	8,166	31,622
1930	25,114	8,941	34,055
1931	25,925	9,445	35,370
1932	26,408	9,583	35,991
1933	26,507	9,736	36,243
1934	26,049	9,742	35,791
1935	26,279	9,795	36,074
1936	26,128	10,436	36,564
1937	26,558	10,577	37,135
1938	27,976	11,066	39,042
1939	28,903	11,415	40,318
1940	29,964	11,675	41,639
1941	31,828	12,264	44,092
1942*	33,538	13,274	46,812

Source: Federal Power Commission. * Estimated.

North Central and West South Central shows more hydro capacity and all show additions of fuel-generating capacity, even though these were small in magnitude in the Mountain and Pacific areas.

Regionally the increases in fuel generating capacity were as follows in percentages: N.E., 7; M.A., 3.5; E.N.C., 5.3; W.N.C., 3.5; S.A., 9.1; E.S.C., 20.0; W.S.C., 4.5; Mountain, 2.0; Pacific, 3.2. Corresponding percentage increases of hydro are: N.E., 0.8; M.A., 0.2; E.N.C., 1.3; W.N.C., 0; S.A., 7.8; E.S.C., 22.8; W.S.C., 0; Mountain, 10.2; Pacific, 10.8.

These data show the rising significance, in electrical magnitudes, of the South Atlantic and East South Central regions which got the largest fuel-using increments and joined their TVA with the Rockies and Bonneville-Grand Coulee developments to command (along with the Mountain and Pacific areas) the lion's share of the enlargement in hydro capacity.

Despite all the attention focussed on hydro, the earlier-established steam-power generation is yielding relatively little of its dominance. In 1929 fuel power made 74.2 percent of the total. It had receded to 71.5 by 1936 and then recovered to 72.3 in 1941.

Now, largely because of large unit additions at government projects in 1942 it is down again but only to the 71.5 percent standing of 1936-1938.

GENERATING CAPACITY BY OWNERSHIP

(In Thousands of Kw.)

Year	Privately Owned				Government-Owned		
	Electric Utilities	Mining and Mfg.	Railways	Sub-total	Local†	Federal	Sub-total
1928	25,990	445	1,464	27,900	1,602	213	1,814
1929	27,953	420	1,363	29,736	1,673	214	1,887
1930	30,285	438	1,232	31,956	1,873	226	2,099
1931	31,498	431	1,240	33,170	1,969	230	2,200
1932	32,033	388	1,216	33,638	2,122	232	2,354
1933	32,163	458	1,198	33,819	2,191	232	2,423
1934	31,547	449	1,223	33,220	2,283	288	2,571
1935	31,820	449	1,190	33,459	2,316	300	2,615
1936	31,787	447	1,036	33,270	2,492	803	3,295
1937	31,958	494	1,021	33,472	2,829	832	3,662
1938	33,246	559	991	34,796	3,090	1,156	4,246
1939	33,908	559	896	35,363	3,304	1,650	4,955
1940	34,399	603	499	35,501	4,195	1,944	6,138
1941	36,041	601	476	37,118	4,603	2,371	6,974
1942*	37,639	.....	.....	38,716	.....	.....	8,096

Source: Federal Power Commission. * Estimated. † Includes cooperatives.

GENERATING CAPACITY BY REGIONS

(In Thousands of Kw.)

Region	1939			1940			1941			1942*		
	Fuel	Water	Total	Fuel	Water	Total	Fuel	Water	Total	Fuel	Water	Total
N.E.	2,177	852	3,029	2,187	876	3,063	2,295	873	3,168	2,459	881	3,340
M.A.	8,175	1,571	9,746	8,281	1,597	9,878	8,841	1,599	10,440	9,150	1,603	10,753
E.N.C.	8,360	710	9,070	8,773	716	9,489	9,383	716	10,099	9,888	726	10,614
W.N.C.	2,626	532	3,158	2,777	539	3,316	2,806	600	3,406	2,902	600	3,502
S.A.	2,782	2,061	4,843	3,031	2,140	5,171	3,392	2,164	5,556	3,703	2,339	6,042
E.S.C.	780	1,221	2,001	778	1,366	2,144	846	1,432	2,278	1,015	1,757	2,772
W.S.C.	1,902	139	2,041	1,951	153	2,104	1,970	279	2,249	2,057	279	2,336
Mountain	576	1,581	2,157	605	1,612	2,217	669	1,692	2,361	683	1,865	2,548
Pacific	1,525	2,748	4,273	1,578	2,675†	4,253	1,626	2,909	4,535	1,681	3,224	4,905
U.S.	28,903	11,415	40,318	29,964	11,675	41,639	31,828	12,264	44,092	33,538	13,274	46,812

Source: Federal Power Commission. * Estimated. † Includes a reduction of 131,000 kw. in rerating equipment from kva. to kw. basis.

GENERATOR RATING—CENTRAL STATIONS, MUNICIPAL, RAILWAY AND OTHER UTILITY POWER PLANTS

Preliminary as of November 1, 1942

Division and State	Number of Companies	Number of Plants	Total Capacity Kilowatts	Generator Capacity in Kilowatts of Plant Operated by [a]					
				Water Power		Steam Power		Internal Combustion Engines	
				Number	Capacity	Number	Capacity	Number	Capacity
United States	[b] 1,779	4,079	46,110,047	1,557	13,158,457	1,208	31,900,247	1,314	1,051,343
New England	145	351	3,264,708	246	881,231	82	2,364,155	23	19,322
Maine	27	86	313,606	67	220,157	8	90,740	11	2,709
New Hampshire	14	58	315,480	48	233,445	6	80,430	4	1,605
Vermont	24	77	176,994	68	[c] 166,452	7	9,850	2	692
Massachusetts	55	83	1,390,452	38	167,262	41	1,214,195	4	8,995
Rhode Island	6	10	281,921	4	3,250	5	278,450	1	221
Connecticut	19	37	786,255	21	90,665	15	690,490	1	5,100
Middle Atlantic	138	411	10,444,686	226	1,603,068	153	8,800,817	32	40,801
New York	72	253	5,811,205	183	1,171,273	55	4,613,750	15	26,182
New Jersey	15	27	1,357,337	5	7,100	17	1,346,300	5	3,937
Pennsylvania	51	131	3,276,144	38	424,695	81	2,840,767	12	10,682
East North Central	331	700	10,567,410	297	725,922	274	9,708,683	129	132,805
Ohio	73	111	3,009,774	7	12,125	82	2,980,301	22	17,348
Indiana	57	90	1,386,651	21	35,494	52	1,324,715	17	26,442
Illinois	66	102	2,828,531	12	48,372	67	2,758,582	23	21,577
Michigan	67	201	2,236,240	131	350,895	34	1,838,825	36	46,520
Wisconsin	68	196	1,106,214	126	279,036	39	806,260	31	20,918
West North Central	472	883	3,493,831	145	599,568	235	2,532,350	503	361,913
Minnesota	77	163	761,981	49	157,399	55	557,254	59	47,328
Iowa	99	182	741,302	33	131,063	50	519,752	99	90,487
Missouri	69	110	856,724	8	158,370	33	642,993	69	55,361
North Dakota	19	43	96,051	.....	.....	17	85,338	26	10,713
South Dakota	37	67	90,075	5	3,270	11	55,112	51	31,693
Nebraska	85	178	419,976	42	142,585	34	223,691	102	53,700
Kansas	86	140	527,722	8	6,881	35	448,210	97	72,631
South Atlantic	172	420	5,930,791	164	2,338,247	139	3,502,115	117	90,429
Delaware	7	8	37,917	.....	.....	4	33,200	4	4,717
Maryland	14	29	755,889	3	271,385	12	474,025	14	10,479
District of Columbia	2	3	358,000	1	3,000	2	355,000	.....	.....
Virginia	29	72	669,801	37	181,474	18	474,710	17	13,617
West Virginia	16	41	793,268	12	100,980	18	687,410	11	4,878
North Carolina	37	86	1,428,208	51	772,780	24	645,041	11	10,387
South Carolina	17	44	792,568	28	650,743	10	137,330	6	4,495
Georgia	16	57	627,201	28	343,492	23	281,375	6	2,334
Florida	34	80	467,939	4	14,393	28	414,024	48	39,522
East South Central	69	176	2,771,847	35	1,757,010	80	989,499	61	25,338
Kentucky	17	43	460,241	4	111,085	29	345,990	10	3,166
Tennessee	17	38	1,050,868	18	736,892	14	312,092	6	1,884
Alabama	11	43	1,196,367	13	909,033	18	282,570	12	4,764
Mississippi	24	52	64,371	.....	.....	19	48,847	33	15,524
West South Central	179	416	2,310,544	34	278,547	102	1,815,098	280	216,899
Arkansas	26	46	157,026	5	67,008	16	73,600	25	16,418
Louisiana	36	64	427,086	.....	.....	10	381,870	54	45,216
Oklahoma	57	106	445,744	4	59,224	25	332,018	77	54,502
Texas	60	200	1,280,688	25	152,315	51	1,027,610	124	100,763
Mountain	174	412	2,464,068	194	1,782,362	81	575,010	137	106,696
Montana	13	31	336,319	18	321,235	5	12,218	8	2,866
Idaho	19	59	269,950	45	266,100	2	650	12	3,200
Wyoming	28	45	86,306	14	49,690	15	32,017	16	4,599
Colorado	37	86	327,820	29	66,125	29	245,069	28	16,626
New Mexico	19	43	144,910	5	25,157	12	99,879	26	19,874
Arizona	23	57	620,938	15	458,290	14	116,427	28	46,221
Utah	26	74	168,364	57	91,830	3	66,250	14	10,284
Nevada	9	17	509,461	11	503,935	1	2,500	5	3,026
Pacific	99	310	4,862,162	216	3,192,502	62	1,612,520	32	57,140
Washington	31	69	1,357,050	48	1,137,605	14	217,420	7	2,025
Oregon	32	81	692,008	52	496,452	19	190,250	10	5,306
California	36	160	2,813,104	116	1,558,445	29	1,204,850	15	49,809

[a] For the 200 combination plants each type of prime mover is counted as a separate plant.

[b] Total includes 84 duplications because of utilities operating in more than one state. [c] Includes 1,000 kilowatts wind power.

Source: Federal Power Commission.

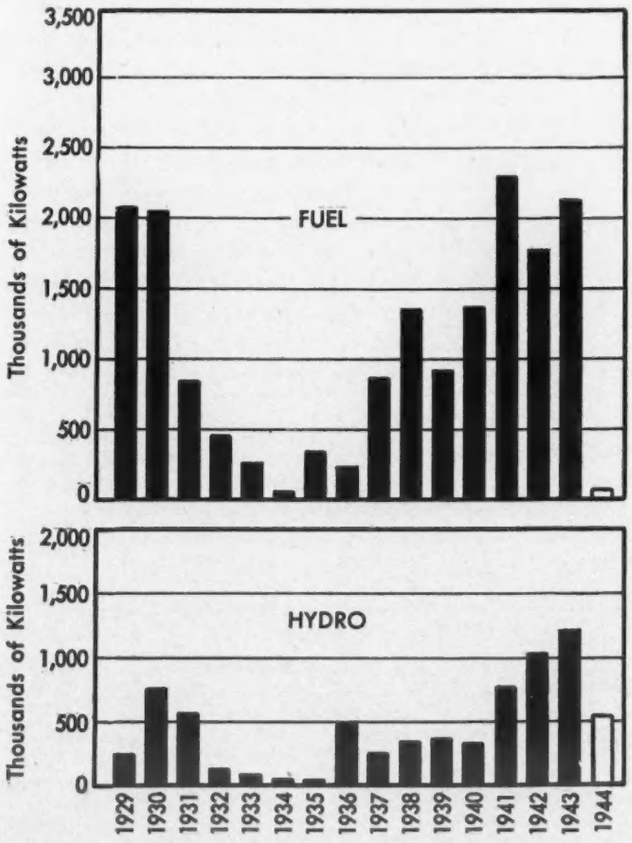
6,700,000 Kw.
NEW CAPACITY

A year ago, when we had just joined the global war, the new electric generating capacity projected for the years 1942, 1943 and 1944 was 8,690,099 kilowatts. Actually installed and remaining on the authorized schedule for the same years are 6,698,262 kw. or 77.2 percent of what had been planned. But still this increase for the three years that began with our entrance into the war is, in fact, 10 percent greater than the combined additions of the three years 1939-41 which marked emergence from the depression.

The amount added in 1942 is greater than any previous year except 1928 and 1941 and practically identical with 1930. It turns out to be 86 percent greater than the average for the preceding 14 years.

The fuel prime-mover additions exceed that average by 63 percent and the hydro by the much greater amount

NEW GENERATING CAPACITY



TOTALS FOR 1942

Kilowatts	Private Companies	Municipal and Federal	Total
Steam....	1,573,000	179,500	1,752,500
Hydro...	83,300	943,600	1,026,900
Internal Combustion....	1,712	2,000	3,712
Total..	1,658,012	1,125,100	*2,783,112

*In previous years "Electrical World's" list of capacity additions was obtained directly from reports of operating companies. The present list was not so obtained, but was assembled from various available sources. The Edison Electric Institute has published a total of new capacity added in 1942 of 2,920,000 kw. The difference between the total shown here and the E.E.I. figure is explained by the absence from this list of instances of rerating generating units and of numerous small installations, particularly internal combustion units.

TOTALS FOR 1943

Kilowatts	Private	Municipal and Federal	Total
Steam.....	1,879,250	255,000	2,134,250
Hydro....	143,000	1,065,000	1,208,000
Total.	2,022,250	1,320,000	3,342,250

TOTALS FOR 1944

Kilowatts	Private Companies	Municipal and Federal	Total
Steam.....	50,000	.....	50,000
Hydro.....	.....	522,900	522,900
Total....	50,000	522,900	572,900

NEW CAPACITY ADDED EACH YEAR

as reported to Electrical World for the entire industry

Year	Kilowatts		
	Fuel	Hydro	Total
1928.....	1,935,500	†1,520,000	3,455,500
1929.....	2,081,085	†249,200	2,330,285
1930.....	2,040,947	748,480	2,789,427
1931.....	836,500	566,500	1,403,000
1932.....	466,300	126,155	592,455
1933.....	251,025	95,325	346,350
1934.....	52,805	41,900	94,705
1935.....	347,140	38,950	386,090
1936.....	231,828	‡489,865	721,093
1937.....	873,414	245,346	1,118,760
1938.....	1,350,303	345,605	1,695,808
1939.....	914,680	370,150	1,284,830
1940.....	1,361,094	332,016	1,693,110
1941.....	2,292,215	786,250	3,078,375
1942.....	1,756,212	1,026,900	2,783,112
1943.....	2,134,250	1,208,000	3,342,250
1944.....	50,000	522,900	572,900

† Kw. estimated; reported wholly or partly in hp.
‡ Including Boulder, 165,000; Norris, 100,000.
* Prospective.

of 141 percent. For 1943 the allocated increments of 3,342,250 total to nearly the 3,455,500 of the previous banner year of 1928. They promise to be over 35 times as great as the dismal low recorded in 1934. Hydro additions in 1943 will constitute 36 percent of the total. Last year (1942) they were 37 percent. For the previous 14 years they had averaged 36 percent. Thus it may be said that hydro generation capacity increments have become better than half as great as those assigned to fuel prime movers.

Beneath the surface of these totals lie a number of factors which have not influenced previous statistics and chief among them is the March, 1942, issuance of the War Production Board of Priority Order M-76 which put land turbines on a formal allocation basis. Previous priority ratings were thereupon rendered obsolete and the manufacturers' schedules of fabrication and delivery subjected to specific direction by WPB. Four months later WPB fixed the additional generating capacity for the duration at 5,300,000 kilowatts of which 1,830,000 were to go into service in the remaining months of 1942, with 2,970,000 for 1943 and a mere 500,000 for 1944. These were carved out of the 9,600,000 kilowatts of generating capacity which the power systems then had on order with manufacturers for delivery through 1945. All the 1945 bookings were suspended and so were 1,200,000 kw. of the 1,700,000 which had been set down as the foresighted requirements for 1944.

While this paring of generating increments is leaving the power systems of the nation with some 3,500,000 kilowatts of total capacity less than they had deemed necessary it has not, so far, at least, created any appreciable deficiencies. The reason, explained in detail elsewhere, is simply that the war load has not been superposed on the normal growth of peacetime consumption but has supplanted much of it and, further, has not, on its own account, established the levels predicted for it.

GENERATING CAPACITY ADDED IN 1942

Steam

Private Companies	*Kw.*
Alabama Power	40,000
American Gas & Electric (Central System)	170,000
Arkansas Utilities	4,000
Boston Edison Co	15,000
Carolina Power & Light	25,000
Central Maine Power	20,000
Central Ohio Light & Power	7,500
Central Power & Light	15,000
Cincinnati Gas & Electric	65,000
Cleveland Electric Illuminating	60,000
Columbus & Southern Ohio Electric	30,000
Commonwealth Edison	50,000
Connecticut Light & Power	40,000
Consolidated Edison System	50,000
Consumers Power	50,000
Dayton Power & Light	30,000
Duke Power	40,000
Duquesne Light	60,000
Edison Sault Electric	3,000
Florida Power & Light	25,000
Georgia Power	40,000
Hartford Electric Light	45,000
Iowa Electric Light & Power	15,000
Louisville Gas & Electric	50,000
Lynn Gas & Electric	10,000
Missouri Power & Light	5,000
Montaup Electric	20,000
New York State Electric & Gas	20,000
Niagara Hudson System	80,000
Northern States Power	50,000
Pacific Gas & Electric	40,000
Philadelphia Electric	80,000
Potomac Electric Power	50,000
Public Service Electric & Gas	75,000
St. Joseph Railway, Light, Heat & Power	6,000
Southwestern Public Service	12,500
Superior Water, Light & Power	10,000
Texas Electric Service	10,000
Texas-New Mexico Utilities	7,500
Union Electric System	80,000
Western United Gas & Electric	12,500
Wisconsin Power & Light	30,000
Wisconsin Public Service	25,000
Total	1,573,000

Municipal and Other Public Plants	*Kw.*
Clay Center, Kansas	1,500
Cleveland	12,500
Fort Wayne, Indiana	15,000
Produce Terminal Corp.	5,000
Salt River Valley Water Users Assn	22,500
Tennessee Valley Authority	120,000
Watertown, S. D.	3,000
Total	179,500

Hydro

Private Companies	
Consolidated Water Power	8,750
Nantehala Power & Light	43,200
Pacific Gas & Electric	31,350
Total	83,300

Municipal and Other Public Plants	
Bonneville Power Administration (including Grand Coulee)	271,000
Kaukana, Wisc.	2,400
South Carolina Public Service Authority	122,400
Tennessee Valley Authority	322,800
U. S. Bureau of Reclamation (excluding Bonneville Power Administration)	225,000
Total	943,600

Internal Combustion

Private Companies	
Iowa Public Service	1,712

Municipal and Other Public	
Rockville Center, N. Y.	2,000

GENERATING CAPACITY TO BE ADDED IN 1943

Steam

Private Companies	*Kw.*
Alabama Power	60,000
American Gas & Electric	250,000
Arkansas Power & Light	25,000
Boston Edison Co	40,000
Carolina Power & Light	25,000
Central Power & Light	15,000
Cleveland Electric Illuminating	50,000
Commonwealth Edison	147,000
Consolidated Gas Electric Light and Power of Baltimore	50,000
Detroit Edison	75,000
Erie Lighting	25,000
Georgia Power	40,000
Gulf States Utilities	20,000
Houston Lighting & Power	30,000
Iowa Electric Light & Power	15,000
Louisiana Power & Light	30,000
Minnesota Power & Light	20,000
Monongahela West Penn Public Service	35,000
New Bedford Gas & Edison	7,500
New Orleans Public Service	30,000
New York State Electric & Gas	35,000
Northern States Power	50,000
Ohio Edison	35,000
Ohio Public Service	50,000
Oklahoma Gas & Electric	20,000
Pacific Gas & Electric	40,000
Pennsylvania Edison	25,000
Pennsylvania Electric	25,000
Pennsylvania Power & Light	31,250
Potomac Electric Power	50,000
Public Service Electric & Gas	125,000
Public Service Company of Indiana	87,500
Rochester Gas & Electric	25,000
San Diego Gas & Electric	35,000
Texas Power & Light	25,000
Union Electric System	80,000
Virginia Electric & Power	50,000
Virginia Public Service	21,000
Wisconsin Electric Power	80,000
Total	1,879,250

Municipal and Other Public Plants	*Kw.*
Burbank (Cal.) Municipal	10,000
Floating Power Units	120,000
Los Angeles, Cal.	65,000
Tennessee Valley Authority	60,000
Total	255,000

Hydro

Private Companies	*Kw.*
Pacific Gas & Electric	128,000
Wisconsin Michigan Power	15,000
Total	143,000

Municipal and Other Public Plants	*Kw.*
Bonneville Power Administration (including Grand Coulee)	528,000
Bureau of Reclamation (excluding Bonneville Power Admin.)	81,600
Tacoma, Wash.	36,000
Tennessee Valley	384,400
U. S. Engineers	35,000
Total	1,065,000

GENERATING CAPACITY TO BE ADDED IN 1944

Steam

Private Companies	*Kw.*
Consolidated Gas Electric Light & Power of Baltimore	50,000

Hydro

Municipal and Other Public Plants	
Bonneville Power Administration (including Grand Coulee)	162,000
Tennessee Valley Authority	163,400
U. S. Engineers	65,000
U. S. Bureau of Reclamation	132,500
Total	522,900

PEAKS and CAPACITIES

From the tabulated and graphic data on these three pages it is apparent that in the over-all respects of regions and of the whole country there has been no time since the nation began producing for war that electric power production capacity has not been amply able to meet demand. The figures for the three Decembers, 1940, '41 and '42, show that the situation as regards sufficiency of electric power has improved.

At the end of 1940 for each 1,000 kw. of peak load in the national total there was a margin of 218 kw. standing by. Regionally the margins ranged from 109 kw. per 1,000 to 407, as are indicated on the December lines on the graph. A year later the ratio in national terms had dropped to 183 kw. per 1,000 and regionally the range was from 52 to 490. When December, 1942, rolled around the national margin had risen to 209 kw. per 1,000, while the regional range had improved by narrowing to 116 minimum and 408 maximum. A substantial contribution to this result came from the introduction of "war time" which is estimated to have held down the national peak by as much as 1,000,000 kw. Thus it is apparent that power supply is in as good position today as two years ago and in substantially better shape than a year ago.

Further, it should be noted that the figures which justify this conclusion are those published by the Federal Power Commission, except for the peak loads of December, 1942, which were estimated by ELECTRICAL WORLD from FPC data up to and including November. The term "Dependable Capacity" is rigorously defined by the commission to exclude any possibility of overstatement and, so defined, many men well informed on the subject believe that it actually results in understatement.

As for the future, the figures indicate that power supply will continue to be adequate for war needs and for essential civilian requirements in the years of war ahead. This assertion is strengthened by knowledge of the electric utility industry, by appreciation of the intelligent and comprehensive methods employed by the Power Division of the War Production Board to integrate electricity production facilities and by the amount of additional generating capacity which is scheduled to go into operation.

Adding to the solidity of confidence in power adequacy in the years ahead is the already indicated trend toward a lessening of the rate of increase in demand for power. The job of building the national war production plant is approaching completion; the period of preparation for war production is coming to an end. This change in the industrial aspect of the war effort means that the demands for materials for the construction and equipment of munitions factories and of process plants, among which materials electric power must be included, will flatten off at more or less fixed levels.

It is too early yet to say positively that growth of electric power demand is slowing up from this cause. The picture is too much obscured by other factors, such as the effects of "war time," of dimout and of conversions from civilian to war production. Also, many plants built for war production, while now completed or practically so, have not yet got into full operation and will not until along in 1943.

However, it is true that a deceleration in demand increase is observable, whatever may be its causes. From September, 1940, to September, 1941, the national aggregate of peak loads increased 3,970,000 kw. For the same

MARGINS OF DEPENDABLE CAPACITIES ABOVE PEAKS

Region	December, 1940			December, 1941			December, 1942, Est.		
	Peaks	Dependable Capacity*	Margins	Peaks	Dependable Capacity*	Margins	Peaks†	Dependable Capacity*	Margins
I	8,794,068	10,730,899	22.0%	9,789,240	11,613,160	18.6%	9,936,373	11,991,226	20.7%
II	5,757,714	6,971,538	21.1%	6,513,688	7,715,440	18.4%	6,802,882	8,289,582	21.9%
III	3,359,584	3,726,458	10.9%	3,837,155	4,036,329	5.2%	4,418,318	4,930,727	11.6%
IV	3,864,458	4,730,829	22.4%	4,325,104	5,102,832	18.0%	4,421,593	5,371,083	21.5%
V	1,328,974	1,840,428	38.5%	1,546,593	2,018,092	30.5%	1,788,125	2,131,489	19.2%
VI	710,756	1,000,277	40.7%	785,180	1,169,895	49.0%	859,070	1,209,170	40.8%
VII	1,635,584	1,950,713	19.3%	1,998,776	2,159,025	8.0%	2,336,709	2,613,995	11.9%
VIII	2,496,933	3,079,960	23.3%	2,773,570	3,543,936	27.8%	2,794,515	3,806,546	36.2%
Total	27,948,071	34,031,102	21.8%	31,569,306	37,358,709	18.3%	33,357,585	40,343,818	20.9%

* Includes reserves and net firm purchases. † Estimated by "Electrical World" on eleven months record in 1942. Source — Federal Power Commission.

twelve months ended in 1942 the increase was 2,226,000 kw. Increases for like periods ending in October were respectively 3,569,000 and 1,287,000 kw. and for the November periods 3,654,000 and 1,779,000 kw. Comparing the actual increase to December, 1941, to the here-estimated increase to December, 1942, the figures are 3,621,000 and 1,788,000 kw. (It is impossible to carry the comparison back any further than September because FPC did not publish figures on peak loads previous to September, 1940). Thus the last four months of 1942 indicate a slowing-up of load increase. Whether or not this trend is maintained in 1943 remains to be seen.

As of December, 1942, the figure for dependable capacity published by FPC is 40,344,000 kw. In 1943 there will be installed 3,342,000 kw. of new capacity. It may be assumed that all of this new capacity will qualify under the FPC definition of "dependable" because the installations are being made according to government determinations of where they are needed. Thus, at the end of 1943 dependable capacity will be 43,685,818 kw.

On other pages of this issue of ELECTRICAL WORLD figures of generating capacity are given. The national total of capacity at the end of 1942 is stated as 46,812,000 kw., a figure considerably higher than the 40,344,000 kw. given by the FPC as dependable capacity. Part of the difference between these two totals is accounted for by the fact that FPC reports only on Class I utilities, those having peak load demands in excess of 15,000 kw. The remainder of the difference is explained by the rigorous definition of FPC of dependable capacity, which excludes much capacity than can regularly be used except under the most unfavorable circumstances. Integration of systems and coordination of operating schedules can qualify a large part of this excluded capacity for admission into dependable capacity. Cooperation between the electric utilities and the Power Division of the War Production Board in this direction—work already done, in hand and planned—will add some 2,000,000 kw. to the total of capacity for load and reserve.

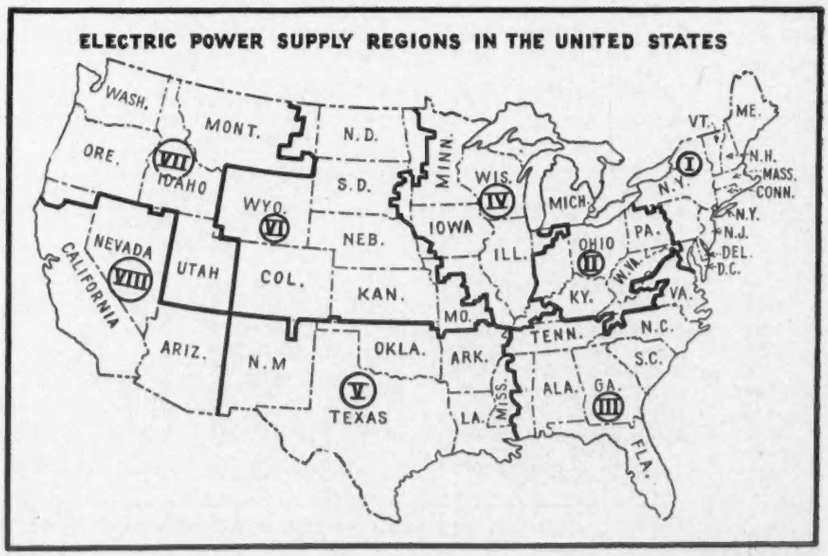
Thus, with additions to capacity made during the year and with gains by integration, the figure of capacity for load and reserve for December, 1943, may be taken at a comfortable 45,000,000 kw.

Against this capacity figure there is to be set the estimate of peak load for December, 1943. This estimate is a variable according to who does the estimating. It ranges from a high of around 39,500,000 kw. down to figures considerably lower. Taking the highest estimate, for every 1,000 kw. of peak load there will be 139 kw. of available capacity standing by. The amount of margin increases as estimates of peak are taken at lower levels. Bearing in mind the foreseeable change in the aspects of war production earlier mentioned, it does not seem probable that the increase in demand for electricity will continue at as rapid a rate throughout 1943 as was established in the earlier phases of the war production effort. Another factor that must be taken into account is the rapidly decreasing production of goods for civilian supply, a condition the full impact of which has not yet been felt.

Dire predictions of national power shortage have been based on estimates of power requirements derived from various ratios of electrical energy needed per dollar of war production or per wage earner hour. The statistical record confounds these predictions and discloses their sources of error. They just did not take into sufficient account the two elements of ability of production capacity to work longer hours and of displacement of civilian by war production.

A simple exercise in statistical analysis shows how the ability of production capacity to work longer hours has been utilized. Let us take 1938 as the last year of wholly civilian economy. In that year the electricity output was 117 billion kw.-hr. In 1942 the output was 189 billion, an increase of 72 billion over 1938. In 1938 production capacity of 38 million kw. worked 3,063 hours; in 1942 capacity of 45.5 million worked 4,147 hours. Now if machines had not been able to work any longer in 1942 than they were in 1938, the increase in output would have been only 22 billion kw.-hr.; 7.5 million kw. of capacity working 3,063 hours. But the increase was actually 72 billion kw.-hr. Therefore, the difference of 50 between 72 and 22 billion, 70 percent, was the result of working capacity for longer hours in 1942 than in 1938.

Evidence of the extent of displacement of civilian by war goods production and of its effect in preventing peak loads from rising as rapidly as was predicted is found in the sales of electricity to industrial plants in 1942. A large proportion of the volume of such sales is included

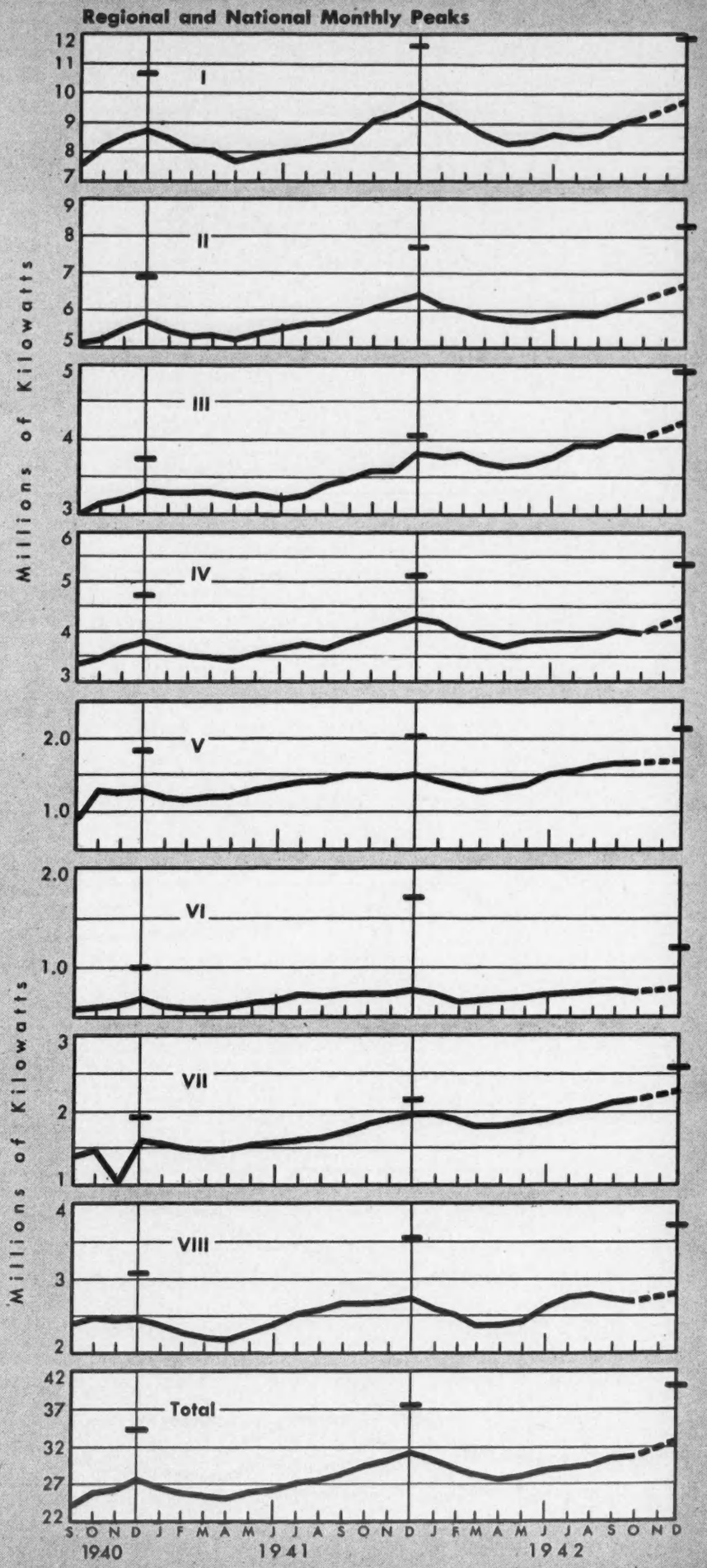


in the classification of "Large Light and Power" (see page 104, this issue). While practically all other classifications of customers show greater increases in 1942 than in 1941 in the amount of electricity they purchased, the "Large Light and Power" customers did not increase their purchases as much in 1942 as they did in 1941. Their increase in 1941 amounted to 16.5 billion kw.-hr., but to only 12 billion in 1942, less than 75 percent of 1941. To have maintained the same rate of increase in energy use in 1942 as in 1941 would have been a significant indication that load was not growing as fast as was anticipated. The fact of an actual reduction in the amount of increase is unmistakable evidence of that conclusion.

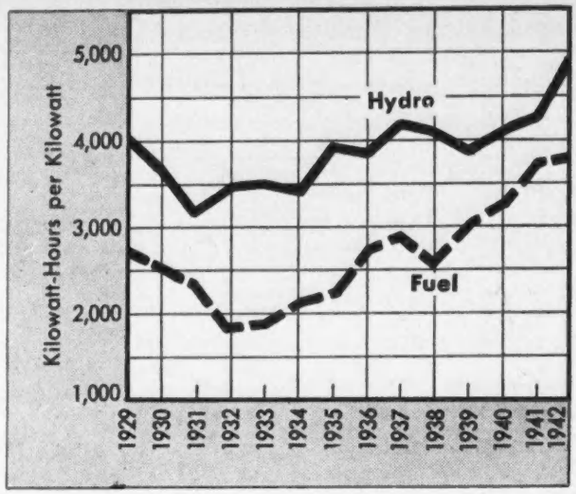
The figures of war goods production given by President Roosevelt in his message on the state of the nation at the opening of the 78th Congress, on January 7, show that such production was tremendously greater in 1942 than in 1941. Therefore it must be concluded that war production has displaced civilian production much more largely than was anticipated, and this is having its effect on demands for electric power.

A prophet determined to disagree with the high estimate of 39,500,000 kw. national peak in December, 1943, could very easily be persuaded by the considerations discussed here into believing that the 1943 peak will not go above 37,000,000 kw. On the basis of this and of a dependable capacity amounting to 45,000,000 kw., there will be 216 kw. standing by for every 1,000 kw. of peak load, an even better situation than that of December, 1942.

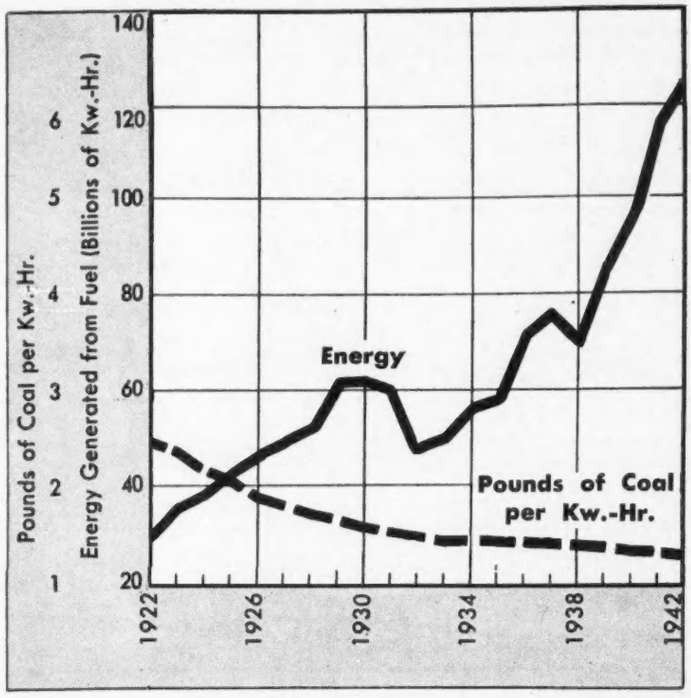
This discussion of the question of power adequacy, dealing with the subject entirely in terms of national totals, does not attempt to say there will be no local shortages in 1943 or later. It is recognized that possibilities of such shortages do exist. But these possibilities need not be viewed as alarming in respect of the war effort. If a shortage occurs in a particular area because of unforeseen emergencies there are numerous expedients that can be employed to prevent interference or hindrance to the task of war production.



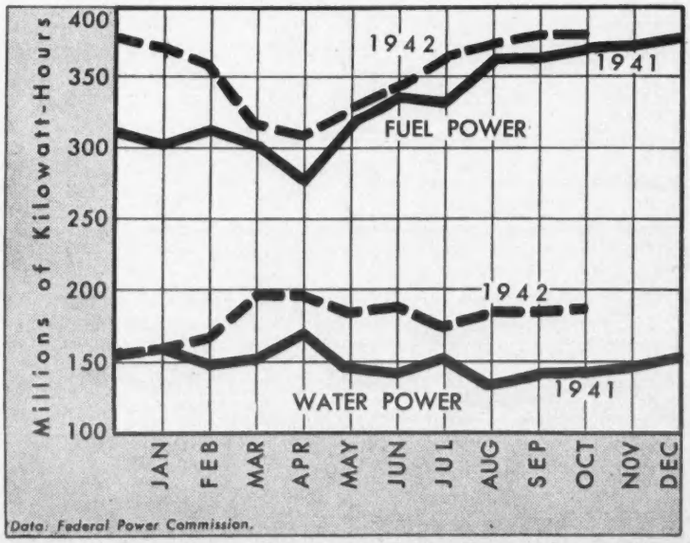
AVERAGE USE OF CAPACITY



OUTPUT FROM FUEL AND FUEL USED



AVERAGE DAILY PRODUCTION OF ELECTRICAL ENERGY



Data: Federal Power Commission.

4,147 Kw.-Hr. per Kw. of Capacity

STATION ECONOMICS

OUTPUT FROM FUEL AND FUEL USED

Year	Energy Generated from Fuel† (Millions of Kw.-Hr.)	Fuel Consumed				
		Coal (Millions of Tons)	Oil (Millions of Bbl.)	Gas (Billions of Cu. Ft.)	Coal Equiv. (Millions of Tons)	Pounds of Coal per Kw.-Hr.†
1924..	38,806	37.56	16.64	48.47	42.69	2.20
1929..	62,295	44.93	10.19	112.62	52.64	1.69
1931..	60,791	38.71	8.13	139.27	47.11	1.55
1932..	48,931	30.30	7.97	107.84	36.70	1.50
1933..	50,546	30.58	9.95	102.73	37.15	1.47
1935..	59,176	34.16	11.38	125.24	43.20	1.46
1936..	72,188	42.03	14.12	156.08	51.99	1.44
1937..	76,883	44.77	14.14	171.27	55.14	1.43
1938..	71,525	40.21	13.08	170.69	50.56	1.41
1939..	85,800	46.22	17.42	191.13	59.51	1.39
1940..	96,609	53.40	16.77	183.16	65.14	1.35
1941..	116,167	64.76	20.25	205.16	77.99	1.34
1942*.	124,095	68.14	16.60	228.50	81.54	1.31

Source: Federal Power Commission. * Twelve months ended October 31.
† Output by use of wood not included.

There was more capacity in 1942 and it was used for more average hours in the year to turn out more kilowatt-hours than ever before. Of both fuel power and hydro power can it be said that the duration of working periods exceeded any previous year; in the case of fuel power the modest extension amounted to a mere 50 hours more than what the hydro drought of 1941 had imposed on it. But the hydro itself in 1942 operated on the average for 666 hours (or practically 27 days) more of the year than in any previous time.

In addition, it is common knowledge, not shown specifically by the accompanying statistics, that fuel power plants have carried higher loads on their units as well as operating the most efficient ones for longer periods. Coupled with the judicious use of generously available hydro, this has manifestly resulted in a new low record of equivalent fuel consumed per kilowatt-hour generated —1.31 pounds. This is a drop of 0.03 from the low reached in 1941.

These facts attest alike the competency of the equipments to stand up under intensified duty, the thoroughness with which inspection, maintenance and overhaul have been conducted in anticipation of the strain and the skill with which operation has been guided.

Hydro, in contributing a third of the generated kilowatt-hours, did it with only 28.4 percent of the total capacity, all because it put in more hours of service. One favorable result was the use of only 3,400,000 additional tons of coal and 23,000,000,000 cu.ft. of gas, despite the 3,600,000 less barrels of critical oil burned under power plant boilers and in diesels.

If the power industry were using as much fuel per kilowatt-hour today as in 1924 it would have consumed the equivalent of 138,000,000 tons of coal. Actually, due to the advance in plant efficiency, abetted by favorable loading, some 57,000,000 tons less were used.

OUTPUT, CAPACITY, AVERAGE USE

Year	Energy Generated (Millions of Kw.-Hr.)			Generating Capacity at End of Year (Thousands of Kw.)			Output per Kw. of Ave. Cap. (Kw.-Hr.)		
	Fuel	Water	Total	Fuel	Water	Total	Fuel	Water	Total
1929...	62,734	33,191	95,925	23,456	8,166	31,622	2,781	4,091	3,128
1930...	62,914	31,738	94,652	25,114	8,941	34,055	2,591	3,710	2,882
1931...	61,149	29,580	90,729	25,925	9,445	35,370	2,396	3,218	2,614
1932...	49,055	33,322	82,377	26,408	9,583	35,991	1,875	3,502	2,309
1933...	50,678	34,058	84,736	26,507	9,736	36,243	1,915	3,526	2,346
1934...	57,093	33,713	90,806	26,049	9,742	35,791	2,173	3,462	2,521
1935...	59,430	39,034	98,464	26,279	9,795	36,074	2,271	3,996	2,740
1936...	72,665	39,516	112,181	26,128	10,436	36,564	2,773	3,906	3,089
1937...	77,348	44,489	121,837	26,558	10,577	37,135	2,936	4,234	3,306
1938...	71,847	44,834	116,681	27,976	11,066	39,042	2,635	4,143	3,063
1939...	86,314	44,022	130,336	28,903	11,415	40,318	3,035	3,916	3,285
1940...	97,232	47,753	144,985	29,964	11,675	41,639	3,303	4,137	3,538
1941...	116,908	51,262	168,170	31,828	12,264	44,092	3,784	4,283	3,923
1942*..	125,300	63,200	188,500	33,538	13,274	46,812	3,834	4,949	4,147

Source: Federal Power Commission. * Estimated.

COAL and WATER

As regards on-hand supply of the raw materials from which electric power is produced, the nation was in much better shape at the end of 1942 than of 1941. On December 1, 1942, electric utilities had in their storage yards sufficient coal to operate their plants for 110 days. On the same date in 1941 coal on hand was sufficient for 67 days. The increase of 43 days' supply was built up by a consistent program of purchase and storage that was begun early in 1942 as provision against possible transportation difficulties such as occurred during the last war. Practically all utilities prepared for this program by enlarging coal storage yards and by increasing yard capacities in various ways.

DAYS' SUPPLY OF BITUMINOUS COAL IN ELECTRIC UTILITY YARDS

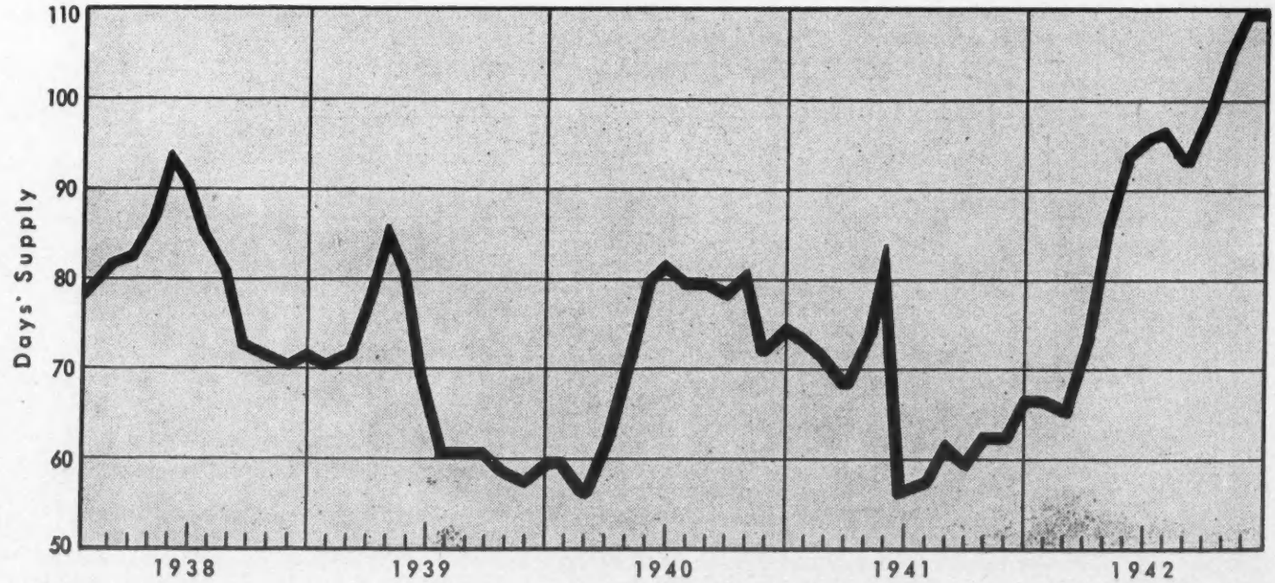
	1938	1939	1940	1941	1942
January 1...	79	71	60	74	67
February 1..	82	72	57	72	66
March 1....	83	78	62	69	73
April 1.....	87	86	71	74	86
May 1.....	94	81	80	84	94
June 1.....	91	69	82	57	96
July 1.....	85	61	80	58	97
August 1....	81	61	80	62	94
September 1.	73	61	79	60	99
October 1...	72	59	81	63	105
November 1.	71	58	73	63	110
December 1..	72	60	75	67	110

The picture of water supply for hydro-electric plants is not capable of presentation quantitatively in national terms as is possible in regard to fuel. On the basis of average thermal efficiency realized in electric utility steam power plants in 1942, it is possible to say that a ton of coal in storage will produce 1,526 kw.-hr. of electricity. But no such conveniently stated relationship can be set up between the rain that falls on the earth and the energy in kilowatt-hours resulting therefrom. There are too many intervening variables and unknowns. Thus in regard to water supply for power production it is possible to speak only in the comparative terms of more or less, better or worse.

In general, it may be said that water supply conditions in the United States are much better now than a year ago. In 1942 rainfall was heavier than in 1941. Ground water levels are now up to normal or above pretty well all over the nation. Storage reservoirs are full. As of November 30, 1942, according to the United States Geological Survey, "water storage in the United States and Canada for power, municipal and industrial use as a whole was about 180 percent of that one year ago." For December the Survey reported that the country-wide pattern of water conditions was practically the same as in November.

It appears, therefore, that on the score of availability of fuel and of water there is little to worry about as regards electric supply in the immediate future, at least.

BITUMINOUS COAL IN ELECTRIC UTILITY STORAGE



Still Growing, but More Slowly

CUSTOMERS

War did not stop the growth in total number of electric utility customers in 1942. The number increased 1.9 percent, but was less than half what it was in 1941. To find a smaller increase in any year it is necessary to go back to 1933, when there was a decrease. However, in only one region, New England, was there an actual decrease in total number of customers in 1942. And in that region there were increases in all classes except one, that of commercial and industrial.

New England was not alone in suffering a decrease in number of commercial and industrial customers. Five others of the nine regions are in the same boat. The net effect of the six regions losing and the three gaining is a reduction in the national total of these customers of almost exactly 100,000, a drop from 1941 of 2.2 percent.

Mortality in the ranks of small business shows plainly through these figures. Certain reductions in numbers of commercial and industrial customers in some states appeared in the 1942 statistical issue of ELECTRICAL WORLD. Those reductions did not amount to a decrease in the national total for the class and were explained as due to reclassification, changing some customers from one class to another. But reclassification cannot explain the large total reduction in 1942, which must be regarded as actual loss by disconnections from the lines of customers going out of business.

Directions of population migration show up quite definitely in the figures of residential customers. The largest increase, 136,557, is in the South Atlantic states, with the East North Central next with 121,925. The third highest increase, 81,894 in the Middle Atlantic states, is considerably lower than the first two, and the Pacific states, with 72,798, are not far behind in fourth place. These four regions with the other five in descending order of increase following them show how mobilization for war, both in training of armed forces and in industrial production, is causing population movement.

The increase of 116,173 in rural customers in 1942 is less than 40 percent of what it was in 1941. This radical decline is the direct result of measures taken to conserve scarce metals by restricting expansion of electric systems to serve new customers, except those necessary to prosecution of the war. Since rural customers have for some years constituted the most rapidly growing class, the effect of restrictions on extensions appears most largely in that group. Nearly one-half of the national increase in rural customers in 1942 was in the West South Central region, with the Pacific states next, the two accounting for 66 percent of the total.

CENTRAL STATION CUSTOMERS AT END OF YEAR

	United States	New England	Middle Atlantic	East No. Central	West No. Central	South Atlantic	East So. Central	West So. Central	Mountain	Pacific
Total Customers										
1942	32,215,888	2,572,003	8,042,550	7,502,354	3,043,757	3,174,119	1,405,912	2,101,596	956,884	3,416,713
1941	31,607,371	2,573,723	7,993,147	7,398,683	3,007,387	3,024,074	1,342,886	2,002,332	919,571	3,345,568
Change	+608,517	−1,720	+49,403	+103,671	+36,370	+150,045	+63,026	+99,264	+37,313	+71,145
Rural Customers*										
1942	1,102,892	17,460	31,686	305,100	123,995	101,140	74,700	110,250	23,261	315,300
1941	986,719	7,753	31,951	295,559	111,376	98,422	73,013	59,192	19,364	290,089
Change	+116,173	+9,707	−265	+9,541	+12,619	+2,718	+1,687	+51,058	+3,897	+25,211
Residential Customers										
1942	26,616,400	2,206,300	6,855,000	6,297,000	2,437,800	2,616,300	1,143,000	1,664,000	788,500	2,608,500
1941	26,025,513	2,204,459	6,773,106	6,175,075	2,416,402	2,479,743	1,077,900	1,606,838	756,288	2,535,702
Change	+590,887	+1,841	+81,894	+121,925	+21,398	+136,557	+65,100	+57,162	+32,212	+72,798
Commercial & Industrial										
1942	4,372,657	341,230	1,130,200	876,145	470,368	444,651	178,450	315,190	140,223	476,200
1941	4,472,653	354,601	1,162,764	905,996	468,636	433,655	182,377	323,047	138,423	503,154
Change	−99,996	−13,371	−32,564	−29,851	+1,732	+10,996	−3,927	−7,857	+1,800	−26,954
Municipal, Rail & Miscellaneous										
1942	123,939	7,013	25,664	24,109	11,594	12,028	9,762	12,156	4,900	16,713
1941	122,486	6,910	25,326	22,053	10,973	12,254	9,596	13,255	5,496	16,623
Change	+1,453	+103	+338	+2,056	+621	−226	+166	−1,099	−596	+90

158,800,000,000 Kw.-Hr.

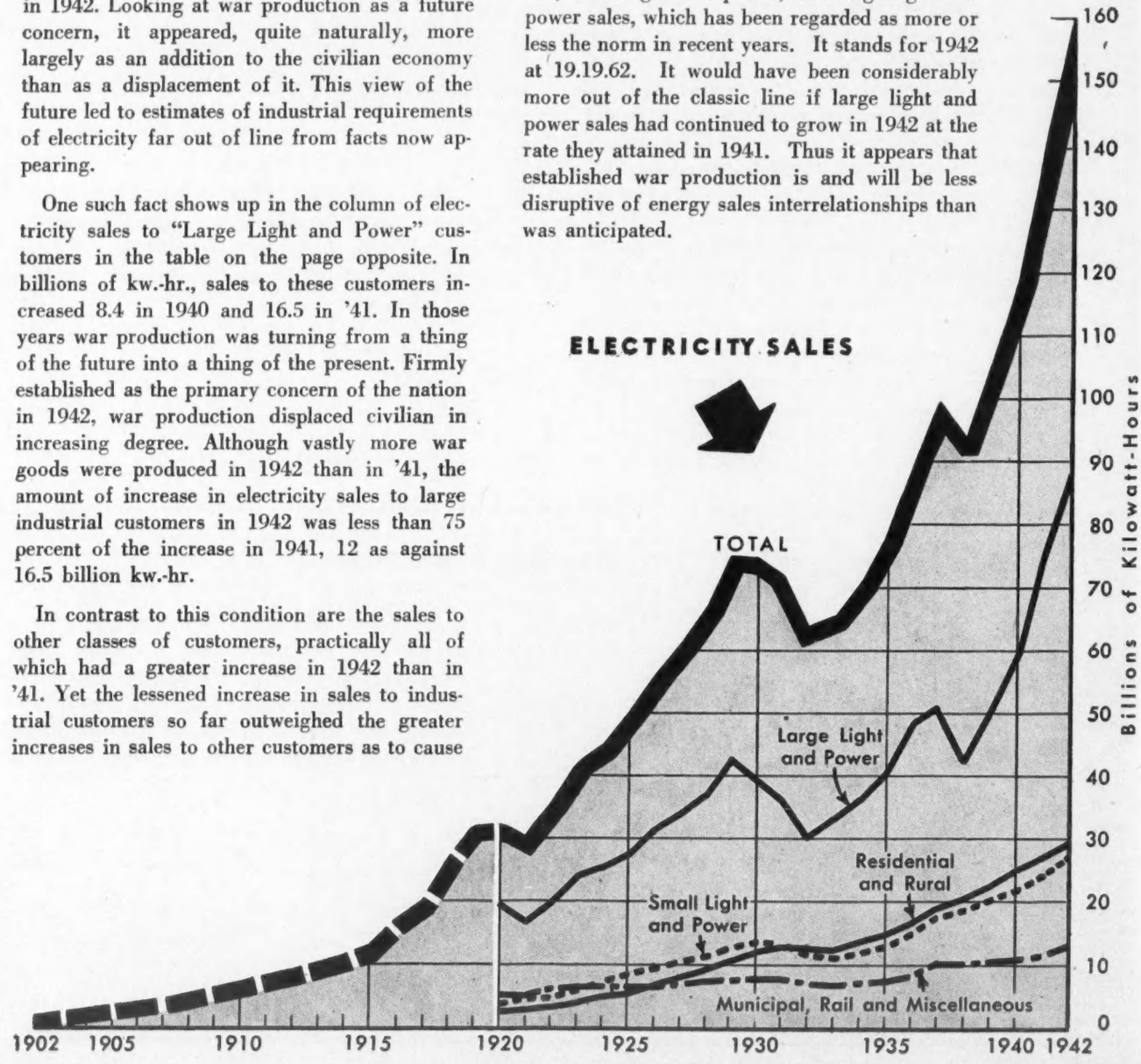
ENERGY SALES

From the 1942 record of energy sales by electric utilities comes evidence that production for war is displacing civilian production more largely than was at first anticipated. In 1940 and '41 war production was something to be figured, estimated and theorized about. It was not the preponderant industrial actuality that it became in 1942. Looking at war production as a future concern, it appeared, quite naturally, more largely as an addition to the civilian economy than as a displacement of it. This view of the future led to estimates of industrial requirements of electricity far out of line from facts now appearing.

One such fact shows up in the column of electricity sales to "Large Light and Power" customers in the table on the page opposite. In billions of kw.-hr., sales to these customers increased 8.4 in 1940 and 16.5 in '41. In those years war production was turning from a thing of the future into a thing of the present. Firmly established as the primary concern of the nation in 1942, war production displaced civilian in increasing degree. Although vastly more war goods were produced in 1942 than in '41, the amount of increase in electricity sales to large industrial customers in 1942 was less than 75 percent of the increase in 1941, 12 as against 16.5 billion kw.-hr.

In contrast to this condition are the sales to other classes of customers, practically all of which had a greater increase in 1942 than in '41. Yet the lessened increase in sales to industrial customers so far outweighed the greater increases in sales to other customers as to cause the increase in total sales to drop from 21.4 billion kw.-hr. in 1941 to 18.7 billion in '42.

This slowing up in rate of growth of large light and power sales while others continued to accelerate was the cause of the only slight change from the classic 20.20.60 relationship of residential, small light and power, and large light and power sales, which has been regarded as more or less the norm in recent years. It stands for 1942 at 19.19.62. It would have been considerably more out of the classic line if large light and power sales had continued to grow in 1942 at the rate they attained in 1941. Thus it appears that established war production is and will be less disruptive of energy sales interrelationships than was anticipated.



ENERGY SALES TO ULTIMATE CONSUMERS

(In Millions of Kw.-Hr.)

Year	Rural	Residential	Small Light and Power	Large Light and Power	Street and Highway Lighting	Street and Interurban Electric Railways	Electrified Divisions of Steam Railroads	Municipal and Miscellaneous	Total to Ultimate Consumers
1929...	1,602	9,526	13,106	42,971	2,038	5,049	590	412	75,294
1930...	1,789	10,703	13,944	40,148	2,227	4,996	591	508	74,906
1931...	1,879	11,373	13,544	36,937	2,330	4,549	626	664	71,902
1932...	1,579	11,494	12,106	30,965	2,033	4,040	568	926	63,711
1933...	1,633	11,358	11,589	33,857	1,893	3,991	668	927	65,916
1934...	1,858	12,233	12,278	36,943	1,896	4,237	692	945	71,082
1935...	1,693	13,496	13,588	40,864	2,078	4,194	841	842	77,596
1936...	2,138	14,992	15,612	48,655	2,223	4,401	1,115	908	90,044
1937†..	1,670	17,691	18,075	51,360	1,863	4,428	1,284	2,987	99,359
1938†..	1,577	19,371	19,137	43,140	1,929	3,989	1,449	3,138	93,731
1939†..	1,881	21,084	20,722	51,108	2,002	3,918	1,847	3,205	105,768
1940†..	1,991	23,318	22,373	59,557	2,048	3,974	1,935	3,447	118,643
1941...	2,352	25,124	24,628	76,060	2,111	3,960	2,118	3,707	140,060
1942*..	2,900	27,000	27,350	88,000	2,000	4,200	2,400	4,950	158,800

Source: Edison Electric Institute. *Estimated. †Revised figures to conform with Uniform System of Accounts prescribed by Federal Power Commission.

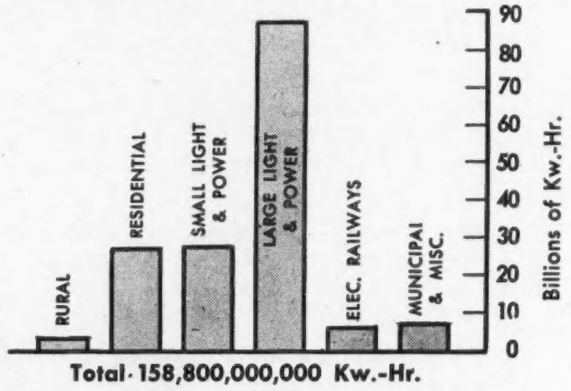
Since the lesson of the early '30 depression years—that residential customers could and would use many more kilowatt-hours than was previously thought possible—was learned and its precepts applied, residential and small light and power sales have been running neck-and-neck—one, then the other, ahead. Possibly the small lead that energy use by small light and power customers took in 1942 may be the beginning of an enlarging difference in the sales to the two groups.

In spite of an actual decrease in their number in 1942 (See "Customers," page 103) small light and power customers continued to accelerate the increase of their total use of energy. This is the result undoubtedly of conversion to, and longer hours of work in, war production. On the other hand, it is plain that although sales to residential customers did increase in 1942, they will more and more slow up in growth as the war continues.

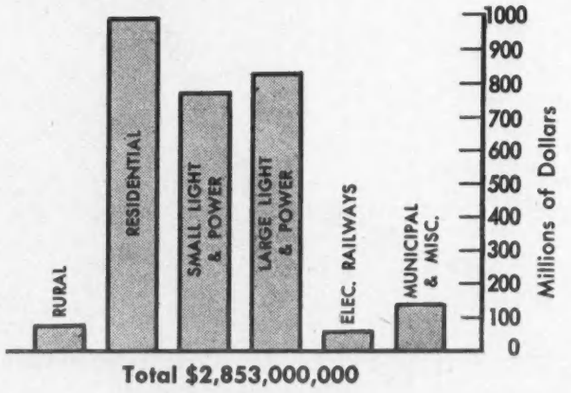
The slowing up of increase in revenue from and in number of rural customers, commented on elsewhere in this issue, seems to be at variance with the accelerated growth of sales of energy to these customers in 1942. The explanation lies in the connection, particularly to REA lines, of a comparatively few large consumption, low unit revenue customers.

Evidencing the greater use of public transportation facilities are the increases in sales to street and interurban railways and to electrified divisions of steam railroads. In the former class there was a decrease in energy purchased in 1941 which changed to a large increase in '42, showing the effect of the rubber shortage on local transportation.

ENERGY SALES BY CLASSES OF CONSUMERS, 1942



REVENUE BY CLASSES OF CONSUMERS, 1942

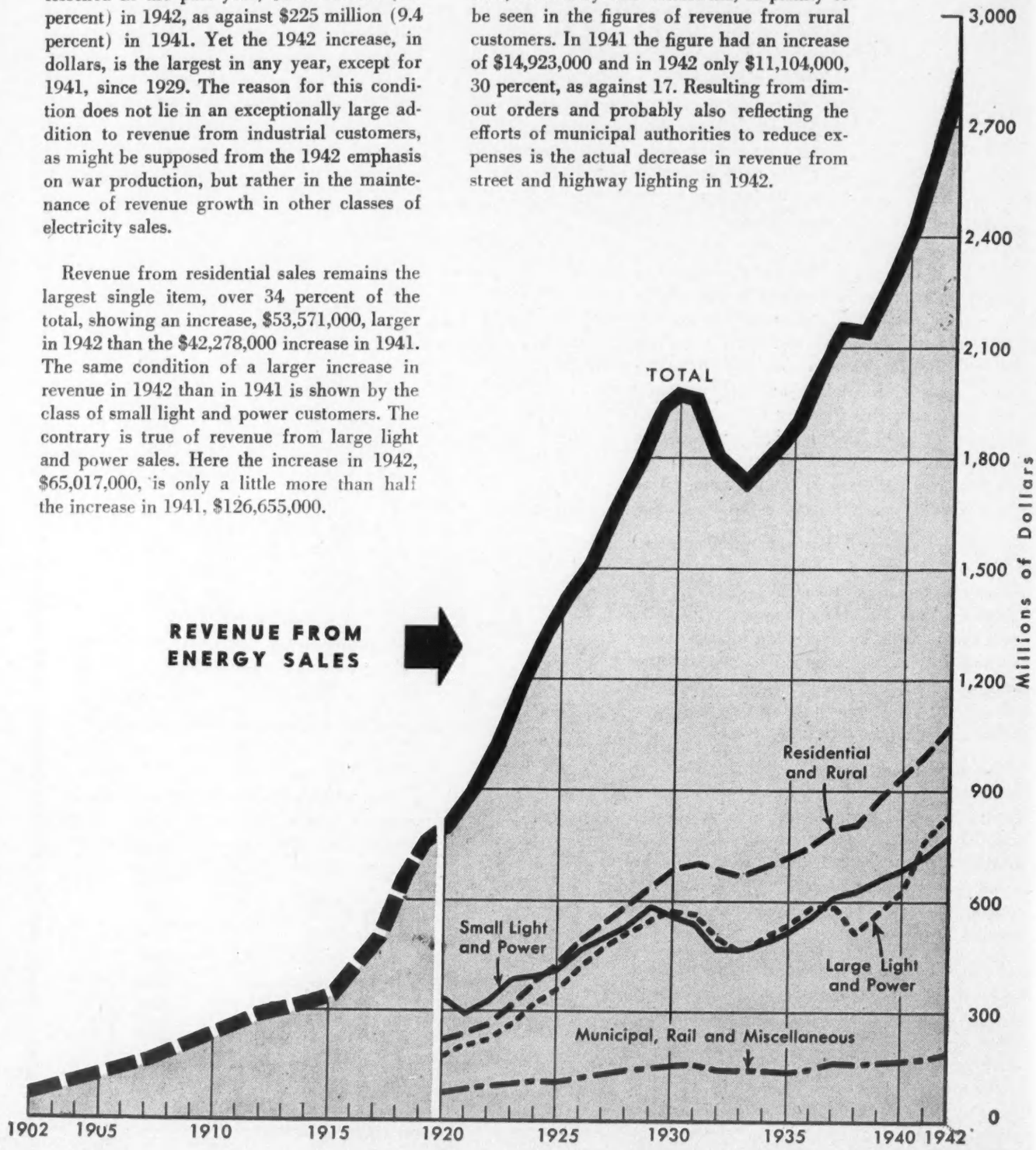


$2,853,000,000 REVENUE

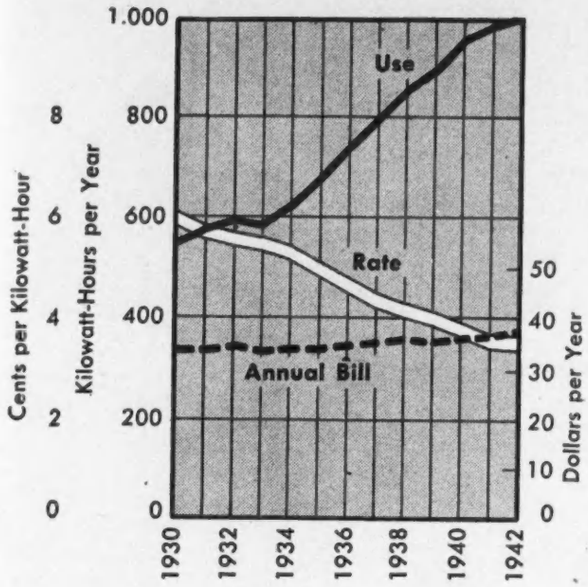
Increase in revenue from electricity sales lessened in the past year, $188 million (7.6 percent) in 1942, as against $225 million (9.4 percent) in 1941. Yet the 1942 increase, in dollars, is the largest in any year, except for 1941, since 1929. The reason for this condition does not lie in an exceptionally large addition to revenue from industrial customers, as might be supposed from the 1942 emphasis on war production, but rather in the maintenance of revenue growth in other classes of electricity sales.

Revenue from residential sales remains the largest single item, over 34 percent of the total, showing an increase, $53,571,000, larger in 1942 than the $42,278,000 increase in 1941. The same condition of a larger increase in revenue in 1942 than in 1941 is shown by the class of small light and power customers. The contrary is true of revenue from large light and power sales. Here the increase in 1942, $65,017,000, is only a little more than half the increase in 1941, $126,655,000.

The stopping of rural electrification expansion, caused by war conditions, is plainly to be seen in the figures of revenue from rural customers. In 1941 the figure had an increase of $14,923,000 and in 1942 only $11,104,000, 30 percent, as against 17. Resulting from dimout orders and probably also reflecting the efforts of municipal authorities to reduce expenses is the actual decrease in revenue from street and highway lighting in 1942.



AVERAGES FOR RESIDENTIAL SERVICE



RESIDENTIAL SERVICE
to Urban and Non-Farm Homes

Year	Kw.-Hr. per Customer	Average Annual Bill (Dollars)	Revenue per Kw.-Hr. (Cents)
1929.....	499	31.44	6.30
1930.....	543	32.58	6.00
1931.....	578	33.18	5.74
1932.....	597	33.25	5.57
1934.....	624	33.07	5.30
1935.....	672	33.53	4.99
1936.....	727	33.81	4.65
1937.....	805	34.62	4.30
1938.....	853	35.31	4.14
1939.....	897	35.88	4.00
1940.....	952	36.56	3.84
1941.....	986	36.78	3.73
1942*.....	1,024	37.58	3.67

Source: Edison Electric Institute. *Estimated.

The conspicuously large increase in revenue from street and interurban electric railways in 1942, in contrast with the decrease from that source in 1941, spells "rubber shortage" in unmistakable terms. Less spectacular, but still worth noting, is the increase in revenue from electrified divisions of steam railroads, 9 percent in 1941 and 12 in 1942.

The figures of residential service averages are extremely interesting as they reveal the effect of war prosperity on the general population. In 1942 wage earners were making more money than in years before. They increased their use of electricity, increased it a little faster than in 1941. Average annual use per residential customer is now comfortably above 1,000 kw.-hr.

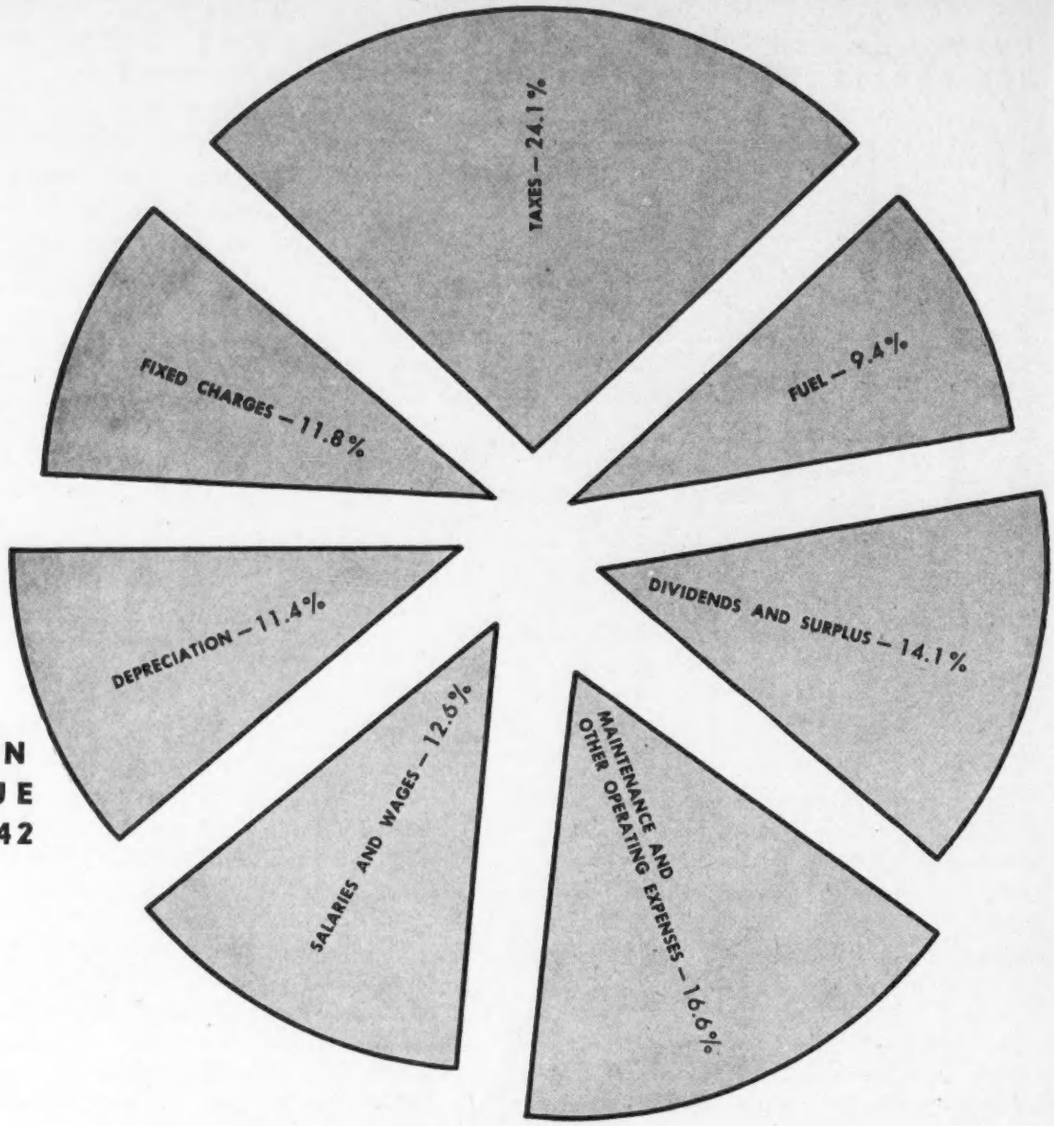
The average annual bill rose 80 cents in 1942 and for this increase the average residential customer got 38 kw.-hr., paying an incremental rate of 2.1 cents per kilowatt-hour. Compared with the average revenue per kilowatt-hour of 3.67 cents, the incremental cost of increased usage remains low enough to be an inducement to more use of electric service.

REVENUE FROM ELECTRICITY SALES

(In Thousands of Dollars)

Year	Rural	Residential	Small Light and Power	Large Light and Power	Street and Highway Lighting	Street and Interurban Electric Railways	Electrified Divisions of Steam Railroads	Municipal and Miscellaneous	Total from Ultimate Consumers
1929....	40,665	600,265	555,640	591,038	88,323	46,277	5,986	10,322	1,938,520
1930....	46,689	642,275	575,598	566,467	95,458	46,067	6,015	12,382	1,990,955
1931....	50,726	653,282	564,523	544,728	99,298	41,912	6,725	14,746	1,975,944
1932....	47,127	640,384	500,993	474,424	89,828	36,701	6,181	18,076	1,813,717
1933....	46,501	623,797	471,780	468,389	83,097	35,098	6,658	19,243	1,754,366
1934....	49,182	648,801	490,420	499,451	81,846	36,402	6,680	19,085	1,831,870
1935....	48,404	673,526	519,213	531,106	79,429	36,431	7,944	15,933	1,911,988
1936....	59,286	696,997	562,122	581,148	80,791	37,423	9,591	17,225	2,044,586
1937†...	37,726	759,824	616,438	583,197	72,740	37,019	10,761	43,091	2,160,798
1938†...	38,928	802,532	632,091	518,694	74,323	33,512	11,995	44,504	2,156,580
1939†...	45,484	843,158	660,683	572,659	75,443	32,573	14,427	45,154	2,289,583
1940†...	49,473	895,951	689,253	631,428	76,052	32,740	15,068	50,252	2,440,218
1941....	64,396	938,229	725,117	758,083	76,949	32,471	16,474	53,338	2,665,057
1942*...	75,500	991,800	771,800	823,100	75,300	34,800	18,500	62,200	2,853,000

Source: Edison Electric Institute. * Estimated. † Revised figures to conform with Uniform System of Accounts prescribed by Federal Power Commission.


TAXES – 24.1%
FUEL – 9.4%
DIVIDENDS AND SURPLUS – 14.1%
MAINTENANCE AND OTHER OPERATING EXPENSES – 16.6%
SALARIES AND WAGES – 12.6%
DEPRECIATION – 11.4%
FIXED CHARGES – 11.8%

ALLOCATION OF REVENUE DOLLAR, 1942

Now Over a Billion Dollars

EXPENSES

Figures of operating revenues and expenses show again what is plainly to be seen in the 1942 records of output, sales and revenues of the electric utility industry—a general slowing up in the rate of growth. Increase decelerates in every department except taxes; the effect of war is plain.

Operating revenues rose $198,000,000 in 1941 and only $155,000,000 in 1942; operating expenditures rose $92,000,000 1941 and only $60,000,000 in 1942. But taxes continued their rise with increased speed, $107,000,000 in 1941 and $124,000,000 in 1942.

The pie chart on this page in the 1942 statistical number of ELECTRICAL WORLD showed that salaries and wages took 14.9 cents of the revenue dollar in 1941, as against the 12.6 cents shown here for 1942. Dividends and surplus show a deeper cut, from 18.3 to 14.1 cents. All other sharers in the revenue dollar took larger parts of it in 1942 than in 1941. Taxes up 3.6 cents, maintenance and

Privately Owned Establishments*
(In Millions of Dollars)

Year	Operating Revenue	Operating Expenditures	Taxes
1933.....	1,640	600	212
1934.....	1,710	635	239
1935.....	1,785	669	251
1936.....	1,911	721	281
1937.....	2,031	781	308
1938.....	2,018	762	323
1939.....	2,148	798	352
1940.....	2,277	863	404
1941.....	2,475	955	511
1942†.....	2,630	1,015	635

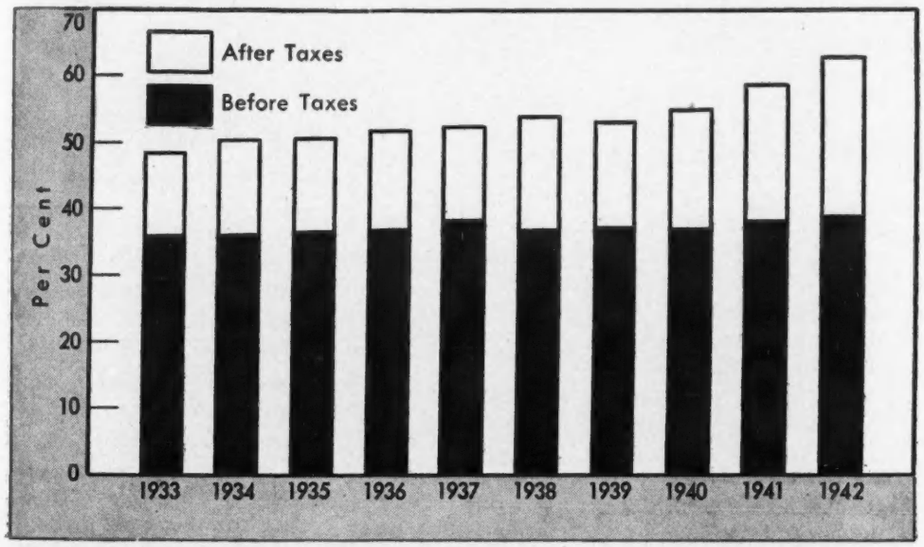
Source: Edison Electric Institute.
* Data adjusted to cover only utilities operating as private enterprises on December 31, 1941.
† Subject to year-end revisions.

OPERATING REVENUE, EXPENDITURES, TAXES

Privately Owned Establishments

	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942
Before Taxes...	36.0	36.6	36.9	37.3	38.5	37.3	37.4	37.5	38.4	38.6
After Taxes...	48.8	50.6	50.9	52.2	53.8	54.2	53.3	55.3	58.9	62.6

OPERATING RATIO BEFORE AND AFTER TAXES



other operating expenses up 2.1 cents, fuel up 0.4 cent and all the others each up 0.2 cent. These changes in the allocation of revenue to cost elements faithfully reflect war conditions.

Worthy of note are the increase in maintenance and other operating expenses and the decrease in salaries and wages. The latter results from a drop in the number of employees, many of whom have entered the armed services, while others have moved to other kinds of war work. The increase in maintenance costs is a direct effect of greater output of electricity accomplished by longer hours of use of facilities and of measures taken to retain equipment in service because of difficulty or impossibility of replacement.

Although the operating man faced and solved more troublesome problems in 1942 than in previous years, he managed to hold expenses down to such effect that operating ratio, before taxes, showed only a 0.2 percent rise from 1941. His opportunity to do this probably was enlarged by the dropping or curtailment of certain "customer service" activities and by revisions of operating practices such as lengthening of meter reading intervals.

$300,000,000 BUDGET

The record of electric utility capital expenditures for new construction, actual for 1942 and prospective for 1943, gives the validation of figures to knowledge already widespread. Every interested person has known for many months that 1942 expenditures would be far below 1942 budgets and that prospective expenditures for 1943 would drop sharply. The figures on this page merely put that knowledge into quantitative terms.

Because of the conditions of war time, ELECTRICAL WORLD did not make this year its customary comprehensive survey and report on electric utility expenditures and budgets. Therefore the figures here presented, by courtesy of the Edison Electric Institute, do not line up with the tabulations of previous years. For instance, the data here are for privately owned utilities only; they do not cover municipal and other government-owned utilities. However, they are sufficient to show the effect of war by comparison of 1942 and 1943 with 1941, when restrictions on expansion did not bear down so heavily as now.

There is an apparent discrepancy between the capital expenditures in 1942 and 1943 for production and the statements of new capacities for those years reported elsewhere in this issue. The prospective expenditure for new capacity in 1943 is down about 30 percent from 1942, while the quantity of new capacity for 1943 is up about 25 percent above 1942. The reason for this is the fact that each year normally includes expenditures for capacity coming into operation the next year. But additions to capacity in 1944 will be very small and thus they add little to 1943 expenditures.

New construction for additions to generating capacity, as is shown also by the statistics under that heading, continued through 1942 at practically the same rate as in 1941. Expenditures for transmission system, necessary for integration of generating capacity to realize its utmost effectiveness, rose in 1942 above 1941 and was about 90 percent of the amount budgeted.

It is in the department of distribution that the most drastic effect of war scarcities is to be seen. From the distribution expenditure of 254 million dollars in 1941 there is a drop of 114 million to the figure of 1942. That the reduction had been anticipated to some extent appears from the setting of the 1942 budget at a level lower than the expenditure of 1941. And how anticipation has been radically revised by experience is shown by the modest figure of 88 million dollars for prospective distribution expenditures in 1943.

A very free-hand estimate of the proposed expenditure for new construction in 1943 by all kinds of electricity systems contributing to the public supply might be made by comparison of the 1941 expenditures of these utilities and the expenditures of the total industry for that year shown in the 1942 statistical number of ELECTRICAL WORLD. On that basis the total budgeted for the whole industry for 1943 is about 300 million dollars.

CAPITAL EXPENDITURES BY CLASSES OF CONSTRUCTION

(in Thousands of Dollars)

	1941	1942		1943
	Actual	Prospective	Actual	Prospective
Production	220,832	261,195	220,076	134,464
Transmission	86,876	108,022	97,346	38,954
Distribution	253,764	226,551	140,356	88,413
General	30,447	26,177	16,286	8,992
Total	591,919	621,945	474,064	270,823

CAPITAL EXPENDITURES FOR NEW CONSTRUCTION

(in Thousands of Dollars)

	1941		1942		1943
	Prospective	Actual	Prospective	Actual	Prospective
New England	43,928	48,255	53,839	37,861	16,846
Middle Atlantic	143,586	135,135	128,944	101,507	47,254
East North Central	195,140	171,687	182,106	131,918	73,186
West North Central	32,816	33,343	38,808	26,762	17,181
South Atlantic	80,249	93,615	89,737	76,194	53,652
East South Central	18,137	21,298	21,524	19,556	7,266
West South Central	26,047	26,289	36,235	27,275	19,864
Mountain States	10,373	12,582	8,164	6,088	5,430
Pacific States	46,825	49,614	62,589	46,903	30,144
Total	597,102	591,919	621,945	474,064	270,823

Refunding Declines Sharply

FINANCIAL

Although total financing in 1942 by electric utilities dropped to 47 percent of what it was in 1941, 352 million dollars as against 741 million dollars, the amount of new capital taken into the industry was practically the same in both years, 97 million dollars in 1941 and 92 million in 1942.

The large decrease in the total was almost entirely accounted for by the sharp decline in refunding, which had been steadily falling off from 1939, and in 1942 took a nose dive to less than half its amount in 1941. Probably there is to be discerned in this condition the effects of two forces. One is the rise in the average yields of mortgage bonds, debentures and notes, all significantly higher than in 1941. The other is the large preemption by Victory bonds of funds that would otherwise be available for usual financing operations. Also, since 1929, about 8 billion dollars of debt have been refinanced. Maybe the desirability of refinancing is disappearing.

The proportion of equity financing in the total of 1942 was the smallest in four years—8.5 percent, as against, roughly, 16, 14 and 12 respectively for the years back through 1939. Perhaps here again is to be seen the claiming of funds by war financing, although the decrease in expenditures for new construction in 1942 and the reduction in construction budget for 1943 undoubtedly had their effect.

An interesting aspect of 1942 financing appears in the distribution of senior securities between public and institutional investors. In 1941 institutional investors took 41 percent of these securities and in 1942 less than 30 percent.

Yields on bonds, debentures, notes and preferred stocks sold in 1942 averaged higher than on those sold in 1941. The percent averages for 1941 were: Bonds, 3.12; debentures, 2.91; notes, 2.37; preferred stocks, 4.56. Corresponding figures for 1942 were 3.22, 4.43, 2.87 and 4.81, in every case above the previous year. Probably the same determining factors that raised the figures of yield were responsible also for the smaller numbers of issues in the groups—22 issues of bonds in 1942 as against 54 in 1941; 4 as against 12 issues of preferred stocks—36 total in 1942, 77 in 1941.

Altogether, the 1942 picture of electric utility financial operations shows just about what would be expected of a basic service industry as it enters a period of war economy when expansion is restricted and increasingly heavy emphasis is laid on all-over efficiency of operations.

NEW UTILITY FINANCING TOTALS $351,553,590

No. of Issues	Range of Yield	Amount of Issues
Mortgage Bonds (Av. yield 3.22%)		
4	2.67–2.94	$32,000,000
6	3.00–3.19	105,055,000
3	3.23–3.45	110,000,000
5	3.53–4.00	25,790,000
4	.....	1,143,000
22		$273,988,000
Debentures (Av. yield 4.43%)		
2	3.50–3.75	$10,750,000
2	4.50–5.12	15,500,000
4		$26,250,000
Notes		
1	2.87	$1,000,000
5	....	20,550,000
6		$21,550,000
Preferred Stock (Av. yield 4.81%)		
2	4.00–4.23	$16,262,308
2	4.99–6.50	9,400,000
4		$25,662,308
Common Stock		
3	.....	$4,103,282
Total Financing	.....	**$351,553,590**
Refunding	.....	**259,088,124**
New Capital	.....	**92,465,566**

SECURITY SALES BY CLASSES

(In Thousands of Dollars)

Year	Bonds, Debentures, etc., to		Stocks, Common and Pfd.†	Total Financing†	Distribution of Security Sales*		
	Public Investors	Institutional Investors			New Capital	Refunding	Total Issues
1929.....	523,408		937,051	1,460,459	624,174	257,602	881,776
1930.....	1,114,636	Included	473,218	1,587,854	894,473	403,062	1,297,535
1931.....	1,090,584	in	417,658	1,508,242	424,163	758,741	1,182,904
1932.....	404,840	Col. 1	65,417	470,257	165,728	239,112	404,840
1933.....	53,725		2,523	56,248	6,813	46,913	53,725
1934.....	131,175		.....	131,175	2,431	128,744	131,175
1935.....	957,042	110,629	8,229	1,075,900	26,496	1,049,404	1,075,900
1936.....	1,122,800	156,881	52,259	1,331,940	59,727	1,272,213	1,331,940
1937.....	522,613	37,604	86,095	646,312	81,984	563,699	645,682
1938.....	750,549	192,762	20,694	964,005	123,056	840,949	964,005
1939.....	620,205	252,625	123,517	996,347	16,219	980,128	996,347
1940.....	660,716	188,976	139,767	989,459	92,376	897,083	989,459
1941.....	368,712	255,912	116,208	740,832	97,065	643,767	740,832
1942.....	226,800	94,988	29,766	351,554	92,466	259,088	351,554

† Including rights and warrants. * Not including common stock rights and warrants.

DIVESTMENTS

From the effective date of the so-called holding company act, passed by the Congress in 1935, well over one hundred operating electric utilities and subsidiary holding companies have been severed from the parent stem. The following list of divestments, prepared as of November 15, 1942, for ELECTRICAL WORLD by the Public Utilities Division of the Securities and Exchange Commission, names 105 companies whose systems, in whole or in part, have been sold or otherwise transferred in ownership. Although all effort was made to assure completeness of this list, it is possible that some divestments do not appear in it. These would be severances made voluntarily, or at least without orders by the Commission, during the time between the effective date of the act and the dates of registration of the holding companies concerned.

It is interesting to note that of the 105 divestments listed, only 9 were made by order of the Commission. This is not to say that the factor of compulsion was entirely absent from the 96 other cases. It is obvious that in many or most of them the action was simply anticipatory of divestment order.

In addition to divested companies the list names 26 holding companies from which, up to November 15, no divestments had been made.

Following the list of divestments is another, naming 120 companies subject to divestment orders. There is a certain amount of duplication in the two lists caused by sales already made of parts of systems.

ELECTRIC UTILITY PROPERTIES SEVERED FROM HOLDING COMPANY SYSTEMS SINCE THE EFFECTIVE DATE OF THE HOLDING COMPANY ACT

System Company	Manner of Divestment	Purchaser	Divested	Required or Ordered by SEC	Date
1. American Gas & Electric Co.			None		
2. American Power & Light Co.					
Texas Power & Light Co.	Sale	Lower Colorado River Authority	Generating, transmission, distribution and other electric assets serving about 14,800 customers in 79 communities	No	9- 1-39
3. American States Utilities Corp.					
Plains Light & Water Co.	Sale	Not known	Physical assets sold	No	Aug. 1937
Rathdrum Electric Co. Ltd.	Sale	Washington Power Co.	Physical assets sold	No	Mar. 1938
Dearborn-Ripley Light & Power Co.	Sale	Public Service Co. of Indiana	Physical assets sold	No	Dec. 1938
American States Utilities Corp.	Sale	International Utilities Corp.	Securities of Hermiston Light & Power Co.	No	July 1939
4. American Utilities Service Corp.					
Ripley Utilities Co.	Sale	Tippah County Electric Ass'n	Electric transmission and distribution system sold in connection with TVA acquisition program	No	4- 1-38
Southern Utilities Co.	Sale	Appalachian Electric Power Co.	Electric utility assets	No	Nov. 1939
Southern Public Service Co.	Sale	Ky. & W. Va. Power Co., Inc.	Electric utility assets	No	Nov. 1939
Wisconsin Central Utilities Co.	Sale	Miss. Valley Public Service Co.	Electric utility assets — Galesville, Wis.	No	Nov. 1939
Ripley Utilities Co.	Sale	Not known	Generating equipment sold in connection with liquidation of the company	No	1939
Louisiana Public Service Corp.	Sale	E. J. Haugh	Electric utility assets — Oak Grove, La.	No	Feb. 1940
Louisiana Public Service Corp.	Sale	Maringouin Ice Factory	Stand-by generating plant — Montegut, La.	No	1940
Roberts County Power Co.	Sale	Otter Tail Power Co.	Electric Distribution system	No	4-29-40
Wisconsin Central Utilities Co	Sale	Northern States Power Co.	Electric utility assets — Augusta and Osseo, Wis.	No	1941
Minnesota Utilities Co.	Sale	Otter Tail Power Co.	Electric utility assets — Wheaton, Minn.	No	1941
Louisiana Public Service Corp.	Sale	Louisiana Power & Light Co.	Electric utility assets	No	1942
5. American Water Works & Electric Co., Inc.			None		
6. Associated Gas & Electric Co.					
Tucumcari Light & Power Co.	Sale	City of Tucumcari, N. Mex.	All facilities	No	7-10-39
Maryland Public Service Co.	Sale	Not known	10 miles of distribution facilities	No	5-29-40
New York State Electric & Gas Corp.	Sale	City of Plattsburg, N. Y.	Distribution facilities in Plattsburg	No	4-10-41
New York State Electric & Gas Corp.	Sale	Rockland Light & Power Co.	Facilities in Sullivan and Orange Counties, N. Y.	No	4-30-41
Associated Maryland Electric Power Co.	Sale	Potomac Edison Co.	All facilities except one transmission line	No	8-12-41
Texas General Utilities Co.	Sale	Universal Elec. Construction Co.	All facilities except transmission lines connecting with Louisiana Public Utilities Co.	No	8-12-41
Ohio River Power Co.	Sale	Tell City, Ind. & Cannelton, Ind.	All assets	No	12-16-41
Arkansas General Utilities Co.	Sale	Walton-Sullivan Co.	All assets	No	12-26-41
Florida Power Corp.	Sale	Talquin Electric Co-op., Inc.	Certain facilities in Gadsden and Leon Counties, Fla.	No	5-23-42
Kentucky-Tennessee Light & Power Co.	Sale	Tri-City Utilities and TVA	All assets	No	5-26-42
Tri-City Utilities Co. (successor to Ky-Tenn. Light & Power Co.)	Sale and exchange	Kentucky Utilities Co. and TVA	Sale of certain assets and acquisition of others (in process before 11(b) (1) Order)	Yes	8-17-42
Brookville Electric Co.	Sale	Penn-Jersey Water; John H. Ware	Included in sale of Northeastern Water & Electric Corp.	Yes	11-10-42
Caribou Water Light & Power Co.	Sale	Penn-Jersey Water; John H. Ware	Included in sale of Northeastern Water & Electric Corp.	Yes	11-10-42
Louisiana Public Utilities Co., Inc.	Sale	Claiborne Electric Co-op., Inc.	Certain electric facilities	Yes	11-10-42
7. Central Public Utility Corp.					
Consolidated Electric & Gas Co.	Sale	Unknown	Voting securities of The Central Public Service Corp., which had four subsidiaries	No	Sept. 1935
Consolidated Electric & Gas Co.	Sale	Public Service Co. of Indiana, Inc.	Sold all securities of Hoosier Public Utility Co.	No	Apr. 1942
8. Cities Service Co.					
Lake Shore Power Co. (Indiana)	Sale	Indiana & Michigan Electric Co.	All facilities	No	8- 1-38
The Citizens Light & Power Co.	Sale	Consumers Power Co.	All facilities	No	12-23-38
Willapa Electric Co.	Sale	PUD #2, Pacific County, Wash.	Electric facilities	No	1-22-40
Grays Harbor Railway & Light Co.	Sale	PUD #1, Grays Harbor County, Wash.	Electric facilities	No	1-15-40

ELECTRIC UTILITY PROPERTIES SEVERED FROM HOLDING COMPANY SYSTEMS (CONTINUED)

System Company	Manner of Divestment	Purchaser	Divested	Required or Ordered by SEC	Date
9. Citizens Utilities Co.					
Newport Electric Corp.	Sale	Two Canadian companies — names not known	Electric utility assets — Abercorn and St. Armand, Que.	No	Aug. 1938
Citizens Utilities Co.	Sale	City of Goodland, Kansas	Electric distribution system — Goodland, Kan. (property condemned)	No	2-24-38
Citizens Utilities Co.	Sale	Inland Utilities Co.	Electric transmission and distribution system — Brewster, Edson and Levant, Kan.	No	1939
Central American Power Corp.	Sale	Ferrocarril del Pacifico de Nicaragua	Electric utility assets	No	-18-41
10. Columbia Gas & Electric Corp.			None		
11. Commonwealth & Southern Corp.					
Tennessee Electric Power Co. and Southern Tennessee Power Co.	Sale	TVA and other public agencies	Electric facilities	No	1939
12. Community Gas & Power Co.			None		
13. Community Power & Light Co.					
General Public Utilities, Inc.	Sale	Nebraska Power Authority	Nebraska Light and Power Co.; Gothenburg Light and Power Co.	No	1941
General Public Utilities, Inc.	Transfer	Black Hills Power & Light Co. (whose securities were then sold to the public)	Directly-owned utility assets in South Dakota, plus those of Dakota Power Co.	No	Oct. 1941
General Public Utilities, Inc.	Sale	City of Holbrook, Ariz.	The Holbrook Light & Power Co.	Yes	Nov. 1942
Community Power & Light Co.	Transfer	Missouri Utilities Co. (whose securities were then sold to the public)	Part of the assets of Arkansas Utilities Co. and securities of Missouri Utilities Co.	No	Oct. 1941
Community Power & Light Co.	Sale	Continental Gas & Elec. Corp.	Securities of the Kansas Utilities Co.	No	Sept. 1942
14. Crescent Public Service Co.					
Empire Southern Service Co.	Sale	City of Bridgeport, Texas	Electric properties	No	1941
Crescent Public Service Co.	Sale	G. M. Dunne and D. E. Dunne	Caney Electric Co.	No	May 1942
15. East Coast Public Service Co.					
Northwest Carolina Utilities	Sale	Blue Ridge Electric Membership Corp.	Certain properties	No	June 1941
Northwest Carolina Utilities	Sale	French Broad Electric Membership Corp.	Remaining properties	No	Nov. 1942
16. Eastern Utilities Associates			None		
17. Electric Power & Light Corp.			None		
18. Engineers Public Service Co.					
Western Public Service Co.	Sale	City of Cozad, Neb.	Electric distribution system — Cozad, Neb.	No	11-14-38
Western Public Service Co.	Sale	City of Auburn, Neb.	Electric utility assets — Auburn, Neb.	No	1- 9-39
Western Public Service Co	Sale	City of Bayard, Neb.	Electric distribution system — Bayard, Neb.	No	7-20-40
Western Public Service Co.	Sale	City of Las Animus, Colo.	Electric utility assets — Las Animus, Colo.	No	10- 1-41
Engineers Public Service Co.	Sale	Consumers Public Power District of Nebraska	Western Public Service Co. (Md.)	Yes	1- 2-42
19. Federal Water & Gas Corp.			None		
20. Great Lakes Utilities Co.			None		
21. Hope Engineering Co.			None		
22. International Hydro-Electric System			None		
23. International Utilities Corp.					
International Utilities Corp.	Transfer	Walnut Electric & Gas Corp.	All directly-owned electric utilities operating in the United States	No	1937
24. Lone Star Gas Corp.			None		
25. Middle West Corp.					
Mount Horeb Electric Co.	Sale	City of Mount Horeb, Wis.	All property and assets located in Mount Horeb, Wis.	No	9-30-39
Central Power Co.	Sale	Consumers' Public Power Dist.	Electric utility properties in Nebraska	No	Jan. 1941
Middle West Corp.	Sale	Ralph J. Green	Common stockholdings in Mo. Pub. Service Corp.	No	July 1940
Central Power & Light Co.	Sale	Houston Lighting & Power Co.	Property located in Sealy, Texas	No	1941
Central Power & Light Co.	Sale	Lower Colorado River Authority	Property located in Colorado River Valley	No	1941
Central Power & Light Co.	Sale	Bondera County Cooperative	Property located in four communities in Texas	No	1941
Central Power & Light Co	Sale	Pedernales Electric Cooperative	Property located in Harper, Texas	No	1941
Kentucky Utilities Co.	Sale	Jackson County Rural Electric Co-op. Corp.	Distribution facilities in Booneville, Ky.	No	1941
Wisconsin Power & Light Co.	Sale	Wisconsin Michigan Power Co.	Electric transmission line	No	1941
26. Midland United Co.					
Public Service Co. of Indiana, Inc.	Sale	Montgomery Light & Power Co.	6 miles of transmission line	No	9- 1-40
Terre Haute & Western Railway Co.	Sale	Indiana General Service Co.	Transmission lines in Windsor and Parker, Ind.	No	12-22-41
27. National Fuel Gas Co.			None		
28. National Gas & Electric Corp.			None		
29. National Power & Light Co.					
Tennessee Public Service Co.	Sale	City of Knoxville, Tenn. & TVA	All electric facilities except one transmission line	No	9- 3-38
Tennessee Public Service Co.	Sale	Appalachian Electric Power Co.	Transmission line	No	9- 3-38
Memphis Power & Light Co.	Sale	City of Memphis and TVA	All electric and gas properties except one generating station	No	2- 6-39
Memphis Power & Light Co.	Sale	Memphis Generating Co.	One generating station	No	2- 6-39
West Tennessee Power & Light Co.	Sale	TVA; Cities of Jackson, Ripley, Krownsville, and Humboldt, Tenn.; Gibson County Elec. Membership Corp.; Southwest Tenn. Elec. Membership Corp.	All electric properties	No	1- 9-39
30. New England Gas & Electric Ass'n					
Middlesex County Electric Co.	Sale	Massachusetts Utilities Associates	All assets	No	6-10-39
31. New England Public Service Co.			None		
32. North American Co.			None		
33. North American Gas & Electric Co.			None		
34. North Continent Utilities Corp.					
Elk River Power & Light Co.	Sale	City of Princeton, Minn.	Distribution system in Princeton, Minn.	No	3- 1-39
Southern Arizona Public Service Co.	Sale	Sulphur Springs Valley Electric Co-op. Inc.	Distribution system at Bowil, Ariz.	No	1941
35. Northern Natural Gas Co.			None		
36. Northern States Power Co.			None		
37. Ogden Corp.					
Estate of Utilities Power & Light Corp.	Sale	Public	All common stock of Newport Electric Corp.	No	5-31-39
Estate of Utilities Power & Light Corp.	Sale	Public	All common stock of Indianapolis P. & Lt. Co.	No	4- 8-40
Interstate Power Co.	Sale	Consumers Public Power District	All electric properties in Nebraska (37 communities)	No	1940
Central States Power & Light Corp.	Sale	F. B. McCurdy of Halifax, N. S.	Entire interest in: Canada Electric Co., Ltd., Eastern Electric & Development Co., Ltd., Moncton Electric & Gas Co., Ltd.	No	1939
Central States Power & Light Corp.	Sale	Otter Tail Power Co.	All securities of Central Light & Pwr. Co.	No	5-12-41
Central States Power & Light Corp.	Sale	City of Benton, Ky.	Distribution system at Benton, Ky.	No	Mar. 1941
Central States Power & Light Corp.	Sale	City of Bordwell, Ky.	Distribution system at Bordwell, Ky.	No	Sept. 1941
Central States Power & Light Corp.	Sale	West Ky. Electric Co-op. Ass'n	Distribution systems at Arlington and Milburn, Ky.	No	Sept. 1941

ELECTRIC UTILITY PROPERTIES SEVERED FROM HOLDING COMPANY SYSTEMS (CONTINUED)

System Company	Manner of Divestment	Purchaser	Divested	Required or Ordered by SEC	Date
Central States Power & Light Corp.	Sale	City of Osage, Iowa	Distribution system at Osage, Iowa	No	Dec. 1941
Central States Power & Light Corp. (Okla.)	Sale	Oklahoma Gas & Electric Corp.	Distribution system at Stonewall, Okla.	No	Oct. 1941
Central States Power & Light Corp. (Okla.)	Sale	Public Service Co. of Oklahoma	Distribution systems at Allen, Atwood and Calvin, Okla.	No	Dec. 1941
38. Pennsylvania Gas & Electric Corp.			None		
39. Peoples Light and Power Co.					
West Coast Power Co.	Sale	City of Cascade Locks, Oregon	Property in that city	No	1939
West Coast Power Co.	Sale	PUD #1 of Skamania County, Wash.	Stevenson electric properties	No	1- 2-40
West Coast Power Co.	Sale	Two PUD's and Bonneville Dam Authority	Lower Columbia River properties in Washington	No	Mar. 1940
West Coast Power Co.	Sale	PUD	Shelton, Wash., electric property	No	3- 3-41
Texas Public Service Co.	Sale	City of Smithville, Texas	Electric and water properties in Smithville	No	1939
Texas Public Service Co.	Sale	City of Weimar, Texas	Electric property in Weimar	No	1939
40. Portland Electric Power Co.			None		
41. Republic Service Corp.			None		
42. Sioux City Gas & Electric Co.					
Iowa Public Service Co.	Sale	City of Manning, Iowa	Distribution system in Manning, Iowa	No	1937
Iowa Public Service Co.	Sale	City of Graettinger, Iowa	Distribution system in Graettinger, Iowa	No	1941
Nebraska Public Service Co.	Sale	Consumers Public Power District	Entire electric department	No	9-12-41
43. Southern Union Gas Co.			None		
44. Southwestern Development Co.			None		
45. Standard Power & Light Corp.					
Standard Gas & Electric Co.	Sale and exchange	Exchanged for notes and debentures of Standard; balance sold to public	Common stock of San Diego Gas & Electric Co.	No	1941
46. United Corp.			None		
47. United Gas Improvement Co.	Sale	Public	Common stock of Conn. Light & Power Co.	No	Apr. 1941
48. United Light & Power Co.					
Iowa-Nebraska Light & Power Co.	Sale	Consumers Public Power Dist.	Electric, heat and ice properties located in Nebraska	No	4- 4-41
Kansas Power Transmission Co., Inc.	Sale	Western Light & Telephone Co.	Electric properties	No	12-31-41
Point Pleasant Water and Light Co.	Sale	Appalachian Electric Power Co.	Electric properties	Yes	1942
Continental Gas & Electric Corp.	Sale	Community Power & Light Co.	Securities of Panhandle Power & Light Co. and Cimarron Utilities Co.	Yes (P.P. & L. only)	1942
American Light & Traction Co.	Sale	City of San Antonio, Texas	Common stock of San Antonio Pub. Serv. Co.	Yes	Oct. 1942
49. United Public Utilities Corp.			None		
50. United Utilities, Inc.					
Southern Nebraska Power Co.	Sale	Central Nebraska Public Power and Irrigation District	All properties	No	Oct. 1940
51. Utilities Stock & Bond Corp.			None		
52. Utility Service Co.			None		
53. Walnut Electric & Gas Co.					
Walnut Electric & Gas Co.	Sale	City of Gallup, N. Mex.	New Mexico Public Utilities Corp.	No	Nov. 1939
South Carolina Utilities Co.	Sale	South Carolina Public Service Authority and City of Myrtle Beach	All assets except cash and accounts receivable	No	May 1941

ELECTRIC UTILITY PROPERTIES SUBJECT AT PRESENT TO DIVESTMENT ORDERS *

System Company	Release No.
1. American Power & Light Co.	3750
Central Arizona Light & Power Co.	
Florida Power & Light Co.	
Kansas Gas & Electric Co.	
Minnesota Power & Light Co.	
Montana Power Co.	
Nebraska Power Co.	
New Mexico Electric Service Co.	
Northern Power Co.	
Northwestern Electric Co.	
Pacific Power & Light Co.	
Superior Water, Light & Power Co.	
Texas Electric Service Co.	
Texas Power & Light Co.	
Texas Public Utilities Corp.	
Washington Water Power Co.	
2. Associated Gas & Electric Corp.	3729
Canadea Power Corp.	
Granville Electric Company	
Litchfield Electric Light & Power Co.	
Long Island Water Corp.	
Jersey Central Power & Light Co.	
Patchogue Electric Light Co.	
Staten Island Edison Corp.	
Richmond Light & Railroad Co.	
York Railways Co.	
Eastern Shore Public Service Co.	
Eastern Shore Public Service Co. of Maryland	
Eastern Shore Public Service Co. of Virginia	
Maryland Light & Power Co.	
Lexington Water Power Co.	
South Carolina Electric & Gas Co.	
Southern Electric Utilities Co.	
Tide Water Power Co.	
Virginia Public Service Co.	
Arizona General Utilities Co.	
Escudero Electric Service Co.	
Louisiana Public Utilities Co., Inc.	
Manila Electric Co.	
Missouri General Utilities Co.	
Missouri Southern Public Service Co	
New Matamoras Electric Co.	
Ohio-Midland Light & Power Co.	

System Company	Release No.
Associated Gas & Electric Corp. (continued)	3729
Ohio River Power Co.	
Panhandle Public Service Co.	
Texas General Utilities Co.	
West Virginia Light, Heat & Power Co.	
Brookville Electric Co.	
Caribou Water, Light & Power Co.	
General Utilities Co.	
Ohio Northern Public Service Co.	
Western Reserve Power & Light Co.	
New London Power Co.	
Broome Electric Corp.	
Lockport Light, Heat & Power Co.	
Paul Smith's Electric Light & Power & Railroad Co.	
3. Electric Power and Light Corp.	3750
Arkansas Power & Light Co.	
Dallas Power & Light Co.	
Idaho Power Co.	
Louisiana Power & Light Co.	
Mississippi Power & Light Co.	
New Orelans Public Service, Inc.	
Utah Power & Light Co.	
Utah Light & Traction Co.	
The Western Colorado Power Co.	
4. Engineers Public Service Co.	
Puget Sound Power & Light Co.	2897
Key West Electric Co.	2897
Western Public Service Co. (Del.)	3230
Missouri Service Co.	3230
Northern Kansas Power Co.	3230
Savannah Electric & Power Co.	3796
Gulf States Utilities Co.	3796
El Paso Electric Co.	3796
5. National Power & Light Co.	2962
Birmingham Electric Co.	
Carolina Power & Light Co.	
Edison Illuminating Co. of Easton	
Houston Lighting & Power Co.	
Lehigh Valley Transit Co.	
Memphis Generating Co.	
Pennsylvania Power & Light Co.	
Roanoke River Power Co.	

System Company	Release No.
6. North American Company	3405
Cleveland Electric Illuminating Co.	
Blue River Power Co.	
Illinois Iowa Power Co.[1]	
Des Moines Electric Light Co.	
Iowa Power & Light Co.[2]	
Kewanee Public Service Co.[1]	
Kansas Power & Light Co.	
Missouri Power & Light Co.	
Potomac Electric Power Co.[3]	
Braddock Light & Power Co., Inc.[3]	
Wisconsin Electric Power Co.	
Wisconsin Gas & Electric Co.	
Wisconsin Michigan Power Co.	
7. Southwestern Public Service Co.	3676
Gulf Public Service Co.	
Arkansas Utilities Co.	
Flagstaff Electric Light Co.	
Arizona Electric Power Co.	
Properties of Southwestern Public Service Company located in East Texas	
8. Standard Power & Light Corp.	2929
California Oregon Power Co.	
Empresa de Servicios Publicos de Los Estados Mexicanos, Sociedad Anonima	
Louisville Gas & Electric Co. (Ky.)	
Madison Light & Power Co.	
Mountain States Power Co.	
Oklahoma Gas & Electric Co.	
Southern Colorado Power Co.	
Wisconsin Public Service Corp.	
9. United Gas Improvement Co.	3511
Arizona Power Corp.	
Connecticut Railway & Lighting Co.	
10. United Light & Power Co.	2923
LaPorte Gas & Electric Co.	
Columbus & Southern Ohio Electric Co.	
Madison Gas & Electric Co.	

* As of November 15, 1942.
[1] Retainable by Illinois Traction Co.
[2] Retainable by Des Moines Electric Light Co.
[3] Retainable by Washington Railway & Electric Co.

Adding Large Customers

REA

Here for the first time in a statistical number of ELECTRICAL WORLD are published directly comparable annual statistics of REA operations. In the 1942 number, in which the present form of tabulated presentation was used, data on two fiscal years were printed, but they were only partially comparable because of the absence of several items from the record of one. Here the record is complete for the calendar years 1941 and 1942, but again some caution should be exercised in making comparisons because the 1942 figures are, necessarily, not actual but estimated.

Expansion of REA systems by new construction was halted in 1942 by wartime controls. The effect of this, one would think, should be to bring the systems more nearly to a strictly operating basis and thus to give to the figures here presented greater validity as representations of operating conditions.

In 1942 average energy sale per customer was 1,123 kw.-hr., 320 kw.-hr. above the average for 1941. This is a 40 percent increase, which cannot be regarded as the accomplishment of one year in the promotion of electric service to farm customers, particularly a year in which the sales of energy-using appliances and equipments were tapering down rapidly. The increase is much more largely the result of additions of heavy users of energy to REA lines—army camps, air fields, process and other industries.

The revenue per kw.-hr. dropped from 4.84 cents in 1941 to 4.16 in 1942, another result of the addition of large customers. These revenues may be set in apposition to those for the whole industry for residential customers reported elsewhere in this issue, 3.73 and 3.67 cents in the two years.

A major decrease in cost of purchased energy is shown from 1941 with 1.05 cents per kw.-hr. to 0.89 cent in 1942. This is a decrease of more than 15 percent, accomplished, no doubt, by lower charges for larger purchases.

Another benefit of larger volume of energy handled appears in the ratio of operating expenses per kilowatt-hour, which declined from 2.66 cents in 1941 to 2.33 cents in 1942. Further result of the larger volume is seen in the reduction of energy losses from 22.7 percent in 1941 to 20.5 in 1942.

Within the limits of slide rule accuracy, it was impossible to see any great difference in ratios of customers per mile in 1941 and 1942. So far as could be discerned it stands without change at 2.6.

STATISTICS OF REA-FINANCED SYSTEMS

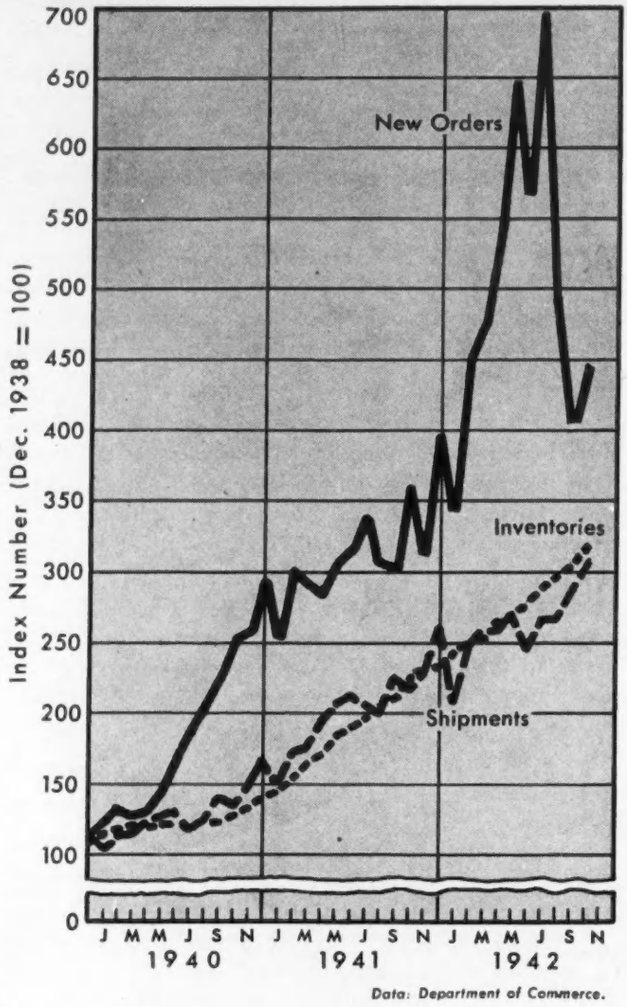
(Prepared on the Basis of Reports Submitted by REA Borrowers)

Item	Fiscal Year Ended June 30, 1941	Calendar Year 1941	Calendar Year 1942*
Cumulative Year-End Data			
Total Funds Allotted	$369,027,621	$433,988,321	$461,000,000
Distribution Lines	$349,234,288	$393,225,088	$409,200,000
Generation and Transmission	$12,289,150	$30,675,150	$41,200,000
Consumer Facilities	$7,504,183	$10,088,083	$10,800,000
Funds Advanced	$296,395,142	$332,033,107	$366,500,000
Systems in Operation	732	773	797
Miles of Line in Operation	307,590	348,062	378,000
Consumers Connected	780,482	902,266	1,010,000
Generating Plants—Number	38	50	60
Generating Plants—Kw. Capacity	32,843	52,000	57,500
Annual Data			
Energy Generated—Kw.-Hr.	55,911,000	83,123,334	130,000,000
Energy Purchased—Kw.-Hr.	684,504,000	854,370,374	1,300,000,000
Total System Input	740,415,000	937,493,708	1,430,000,000
Energy Sold—Kw.-Hr.	568,188,000	724,384,550	1,136,000,000
Operating Revenues	$28,906,000	$35,022,071	$47,200,000
Cost of Purchased Energy	$7,330,201	$8,583,200	$11,530,000
Salaries and Wages	$4,696,000	$5,613,848	$7,111,000
General Expenses	$2,634,581	$3,206,295	$5,554,000
Insurance, Taxes and Misc.	$1,625,514	$1,852,595	$2,310,000
Total Operating Expenses	$16,286,307	$19,255,938	$26,505,000
Net Non-Operating Income	$154,000	$209,968	$280,000
Interest Due and Payable	$3,048,232	$4,417,727	$6,830,000
Interest Accumulated Not Due	$1,828,326	$3,117,438	$2,570,000
Net Income before Depreciation	$7,064,000	$7,931,417	$11,575,000
Payments to Government—Cumulative Data			
Interest Due	$5,460,483	$9,948,438	$19,700,000
Interest Paid	$5,418,622	$9,860,681	$19,610,000
Principal Due	$5,402,177	$5,462,028	$9,160,000
Principal Paid	$8,521,006	$9,286,477	$18,060,000
Overdue Amounts	$124,898	$142,997	$205,000
a. Interest	$41,861	$87,757	$90,000
b. Principal	$83,037	$55,240	$115,000
Advance Payment of Principal	$3,201,866	$3,879,689	$9,015,000

Source of Data: Statistical Reports Published by REA.
1. Special summary of monthly operating reports of REA borrowers.
2. Allotment, construction, operating and financial statistics of REA-financed systems, December 31, 1941.
3. REA monthly statistical bulletins.

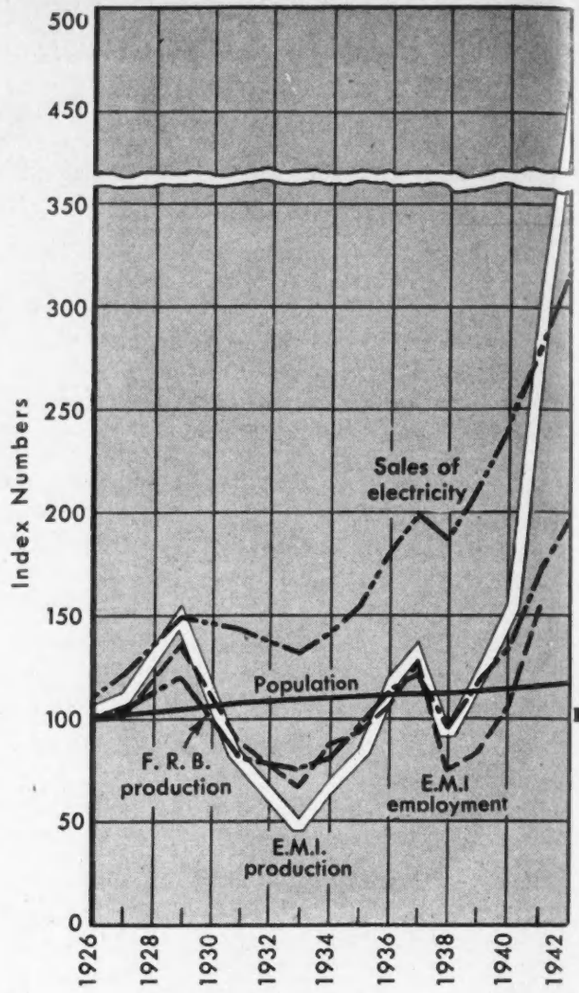
* Nine months actual in most cases and two to four months estimated. Expense items of REA-financed systems are difficult to estimate because of their rapid expansion and development, and because relationships between income and operating data are not comparable with those of more stabilized enterprises. Figures reflect all information available from borrowers, but not every borrower reports on all items. Data on operating expenses of borrowers' systems are not summarized regularly by the Rural Electrification Administration.

ELECTRICAL MACHINERY



Data: Department of Commerce.

ELECTRICAL MANUFACTURING AND RELATED FACTORS



All Out for War

MANUFACTURING

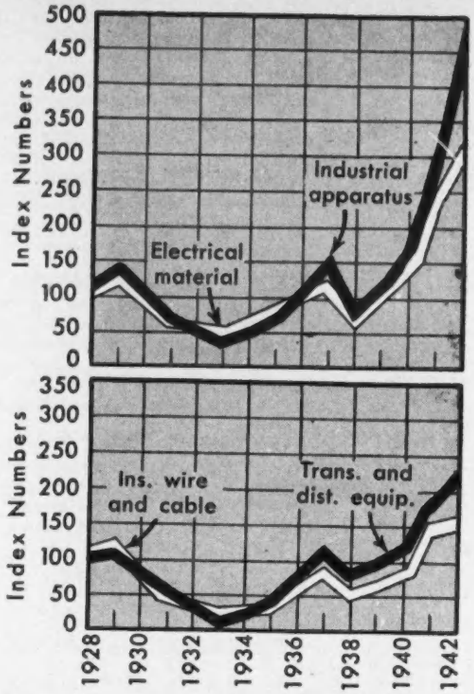
Production indicated by index figures to be of the order of 7 billion dollars gave the electrical manufacturing industry the biggest year in its history in 1942. The indicated production for 1941 was close to 5 billion dollars, much of which was of goods directly for and contributing to war. The 50 percent increase in 1942 thus may be taken as entirely in war production.

Justification for this conclusion appears in the table of sales of specific classes of goods. Manufacture of appliances and refrigerators was discontinued early in 1942 and their sales, probably much less and certainly no larger than in 1941, do not appear in the table. Sales figures of 1942 in other classes of goods do not indicate the immense increase in production represented by the index of 461 in 1942. Therefore it must be accepted that the 1942 increase is in items of production that do not appear, or are not largely represented, in the table of manufacturers' sales; *i.e.*, war goods.

The condition appears also in the graph of "Electrical Manufacturing and Related Factors." "E.M.I. production," which in former years followed quite closely the shape of the curve of "Sales of Electricity," took a sharp upward trend in 1941 and continues on it, swinging high above the curve that was its leader for so long.

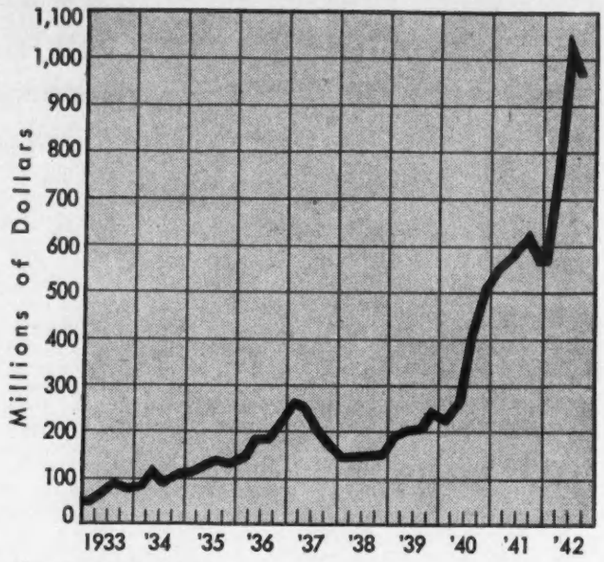
The Federal Reserve Board index of industrial production does not show an increase in 1942 comparable to that of the electrical manufacturing industry production, only 19 as against 50 percent. This disparity results from the fact that electrical manufacturing was able to turn a much larger proportion of its facilities to war goods production than was possible to industry as a whole.

MANUFACTURERS' SALES (Index: 1925 = 100)



ELECTRICAL GOODS

New orders booked quarterly by 78 manufacturers



Data: Department of Commerce.

Indication that electrical manufacturing will probably not maintain in 1943 the rate of increase established in 1942 is plain in the curve of new orders for electrical machinery, which dropped sharply in the third quarter of 1942 and then began a recovery. This curve shows the decrease in demand for capital goods as the production plant for turning out war goods approaches the end of its construction period.

THE INDUSTRY AND RELATED FACTORS

Index Numbers 1925=100

	1931	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942*
1. E. M. I. production	85	51	70	85	119	137	97	123	154	307	461
2. E. M. I. employment	90	68	88	94	106	128	77	84	106	155	†
3. F. R. B. production	82	76	82	96	113	124	97	119	135	173	196
4. Sales of electricity	144	131	141	155	180	199	187	212	238	281	318
5. Population	108	109	110	111	112	113	113	114	115	116	117
6. Electrical goods orders	83	46	63	77	109	133	90	124	205	336	529

Source: N.E.M.A. * Estimated. † Not available.

1. E.M.I. PRODUCTION based on U. S. Census of Manufactures and data compiled by N.E.M.A. statistical department. In addition to products shown in electrical machinery apparatus and supplies schedule of the Census there are included electric refrigeration, radio apparatus and supplies, steam turbines for electrical drive, electrical porcelain, glass insulators and electric washing machines.

2. E.M.I. EMPLOYMENT based on labor series of National Industrial Conference Board, but adjusted to 1925=100. This series represents the electrical manufacturing industry including radio.

3. F.R.B. PRODUCTION based on the Federal Reserve Board's revised index for the manufacturing industry and adjusted to 1925=100. (Entire series revised in 1940.)

4. ELECTRIC POWER SALES index figures based upon Edison Electric Institute data.

5. POPULATION based upon the annual midyear estimates of the U. S. Bureau of the Census.

6. NEW ORDERS booked — electrical goods — based on the quarterly reports of the U. S. Bureau of the Census.

MAJOR BRANCHES OF ELECTRICAL MANUFACTURING INDUSTRY

Index Numbers 1925=100

	Manufacturers' Sales	1931	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942*
1. Appliances	100 = $140,000,000	72	57	73	92	121	136	109	128	151	212	†
2. Refrigeration	100 = 16,000,000	778	574	747	844	1,131	1,360	769	1,100	1,331	1,800	†
3. Electrical material	100 = 38,000,000	71	59	74	93	116	131	83	116	149	253	312
4. Industrial apparatus	100 = 132,000,000	75	47	59	83	118	161	97	127	177	317	483
5. Trans. and dist. equip	100 = 167,000,000	64	22	33	50	83	124	90	104	124	189	232
6. Ins. wire and cable	100 = 110,000,000	54	27	36	46	69	98	60	71	87	157	165

Source: N.E.M.A. * Estimated. † Appliance series discontinued for duration of war.

1. APPLIANCES include domestic kitchen and table appliances, electric ranges, electric water heaters, electric vacuum cleaners, electric washing machines, electric fans and food service equipment.

2. HOUSEHOLD REFRIGERATION includes complete units, parts and cabinets. Commercial refrigeration equipment and air-conditioning equipment are excluded. These index figures appear unusually large because the household refrigeration industry was just beginning about 1925 and therefore the base figure is small.

3. ELECTRICAL MATERIAL includes carbon, electrical porcelain, laminated phenolic products, manufactured electrical mica and vulcanized fiber. Molded insulation is excluded.

4. INDUSTRIAL APPARATUS includes electric welding equipment and wire, industrial controls, industrial heating equipment and motors and generators (excluding all generators except motor-generator sets.) Electric furnaces and electric tools are excluded.

5. TRANSMISSION AND DISTRIBUTION EQUIPMENT includes switchgear, high-voltage insulators, power and distribution transformers, lightning arresters, pole line hardware and earth anchors, panelboards and distribution boards, small air circuit breakers and electrical measuring instruments.

6. INSULATED WIRE AND CABLE for light and power includes wire and cable of various types of insulation such as paper, rubber, varnished cambric and weatherproof used primarily for lighting and power circuits and lines. Bare wire is excluded.

All indices based upon U. S. Census of Manufactures data and N.E.M.A. statistical department data corrected where possible to represent the entire industry.

Chronology of 1942

JANUARY

OPM's southeastern power curtailment program officially cancelled.

First P-46 report forms set up "par" for future.

OPM schedules 2,290,000 kw. steam turbine for utilities during 1942; off 510,000 kw.

FEBRUARY

A-1-a priority order granted to utility pool headed by Arkansas Power & Light Co. to serve Lake Catherine aluminum plant.

NYC-Massena power line gets right-of-way from New York Legislature. Contracts awarded on Taylorville link.

WPB finds Brazos River Transmission Electric Co-operative guilty of violating priorities, prohibits completing 600-mile system.

Two proposals for huge expansion of Government power plants disclosed—one by Bonneville to add 1,193,000 kw. in Northwest; the other by Ickes involving advancement of 17 hydro and steam projects totalling 1,480,000 kw.

MARCH

REA plans expansion by purchasing utility rural lines; disclosure before House appropriations subcommittee.

American Public Power Association organized with headquarters in Washington, D. C.

Formation of national Council of Electric Operating Companies announced.

New regulation concepts urged by High Court minority in dissenting from decision upholding FPC order prescribing a 6½ percent return in the case of the Natural Gas Pipeline Co. of America and Texama Natural Gas Co.

Turbine allocations for utilities drop 290,000 kw.

P-46 change aids utility repair and maintenance—A-2 and A-5 ratings replace A-10.

APRIL

Grand River Dam head protests award by War Department of contract to Oklahoma Gas & Electric Co. to supply new cantonment.

War-time power rationing machinery set up by WPB.

WPB gets full authority over power supply. Agreement with FPC, approved by President, defines responsibilities of each agency in power field.

Army orders "dim-out" for Eastern seaboard.

MAY

Wisconsin Public Service Commission rules utility rates should be "frozen" for the duration in the Wisconsin Telephone Co. case.

Southern California Edison Co. and Los Angeles city power system pool resources for war.

WPB defers Taylorville line.

Senate defers action on Central Valley plant.

JUNE

Electric utilities classified as essential for purposes of administering Selective Service Act.

SEC asserts power over operating companies in Jacksonville Gas case.

Utility employees with dependents rate 3-B class under Selective Service Administration ruling.

Commonwealth & Southern, North American and U. G. I. challenge SEC rulings on "death sentence" in court tests.

WPB revises repair materials rating. A-1-C rating given for 30 percent of necessary maintenance and repair materials in latest P-46 revision.

House, under Presidential pressure, restores appropriation for Central Valley steam plant.

OPA seeks to intervene in Bangor Hydro-Electric rate case.

Government seizes two Puerto Rico utilities under wartime powers.

JULY

OPA revises schedule on industrial machinery. Price Regulation No. 136 goes into effect, with prices pegged at last October's levels.

FPC revises rules on utility contracts with Government agencies. Requires rate increases be filed 60 days prior to effective date.

WPB fixes capacity expansion for duration. Utilities allowed 5,300,000 kw. of facilities, enough to carry through 1943.

Herbert S. Marks replaces Krug as head of WPB power division.

AUGUST

WPB halts work on unfinished REA projects. Co-ops ordered to report inventories of all materials.

Government hydro dams get high priorities.

Bangor Hydro-Electric Co. withdraws request for rate increase.

Eleven utilities form Southwest power pool.

SEC orders Associated to drop 116 subsidiaries.

American Power & Light and Electric Power & Light ordered dissolved by SEC.

Government indicts cable companies on "price plot."

Utilities list unneeded material for sale to other utilities—$24,000,000 worth of material offered during second quarter.

OPA forms new unit to handle rates.

SEPTEMBER

FPC files court brief in case involving jurisdiction over accounting practices of Hartford Electric Light Co. Called test case for entire electric utility industry.

New England utilities form co-ordination group to aid WPB.

Army starts survey of high-voltage line linking Consolidated Edison and Public Service Corp. of New Jersey.

Government releases 100,000 refrigerators.

OPA "veto" power on rate increases sought in amendment to Price Control Act.

Ban enlistment of men in essential jobs. Utility employees in essential categories must obtain direct release from employers.

Court affirms SEC power over operating companies in Jacksonville Gas decision.

Passing on war taxes to consumers in form of higher rates denied by FPC in Panhandle Eastern Pipe Line Co. case.

OCTOBER

Provision in anti-inflation bill requires utilities to give President 30-day notice on rate increases. OPA authorized to intervene.

WPB halts production of additional types of air conditioning and commercial refrigeration equipment.

WPB tightens control over materials, inventory.

Amendment to 1942 tax bill provides tax-free status to new municipal ownership corporations formed to take over utility orphans.

President Roosevelt suggests "common carrier" system to cheapen cost of power to war plants.

Supreme Court denies Justice Department request requiring Appalachian Electric Power Co. to accept FPC's 1942 license, without trial.

WPB further curtails federal power projects.

President Roosevelt designates FPC as overseer of all Government contracts for war power supply.

Utility labor unions organize national group.

NOVEMBER

District of Columbia Public Utilities Commission rejects OPA's plea to intervene "without restriction" in Washington Gas Light case.

OPA defines rules on rate increase notification.

Repairs given AA-1 rating by WPB.

Issue stricter rules for East Coast dimout area.

WPB puts Keswick and Shasta unit No. 5 back on construction schedule. Priorities on five TVA units revoked.

Investment Bankers ask war moratorium on "Death Sentence."

OPA appeals Washington Gas Light decision.

Army extends New England dimout area.

FPC order in Hartford Electric Light case upheld.

Court declares Puerto Rico utility seizure invalid.

DECEMBER

Arkansas Power & Light Co. ordered to make $625,000 rebate by state board. End-of-year principle for control of rates is established.

President Roosevelt places all manpower allocation under Paul V. McNutt.

Motor buyers must prove Hp. need.

Far-reaching changes in WPB's new P-46 order under preparation.

U. S. sues to end "fluorescent monopoly."

Court rules for utility on Niagara water rights.

Southwest power pool rate hearing opens. First test case of FPC's authority to renegotiate contracts.

Parker Dam goes into operation.

Fourteen utilities oppose sale of 20-county power system of Missouri Electric Power Co. to Sho-Me Power Cooperative.

WPB establishes new inventory control section. Charles E. Kohlhepp, vice-president of Wisconsin Public Service Corp., to direct new program for redistribution of "surplus" utility inventory.

A Survey

Some of the situations which developed in 1942 and which may affect the future course of the electrical industry

S. B. WILLIAMS,
Editor "Electrical World"

BY AND LARGE the first full year of war wasn't nearly as rough on the economy of the electrical industry as was expected. There were no areas of power shortage, no deficiencies in rainfall, no war load difficulties that could not be taken care of promptly. That does not mean that the year was free from problems—there were plenty—and some of them most disturbing. It is apparent, however, as one reviews the year, that the utilities had geared themselves to do a bigger job than was required of them. They came out of the year better able to service the demands of war and with a new understanding of operating economies that will last long after the war is over.

Although the production of war goods surged way beyond the defense demands of 1941, the increase in consumption of electrical energy was not as great. The kilowatt-hour output last year was 185½ billion, an increase of some 20 billions, or 12 percent. In the previous year the increase was 23 billion, or 16½ percent.

Two and three-quarter million kw. of new generating capacity were placed in service during the year, with another 4 million on order, mostly for this year's delivery.

By the end of 1942 the capacity of the industry had risen to 46.8 million kw., of which fuel accounted for 71.6 percent and hydro 28.4 percent—a new high for the latter.

Deceleration

Abundant evidence that the war plant is pretty nearly all built and the job ahead is now but one of production is seen in the deceleration of the national non-coincident peak. In 1941 it rose 3.6 million kw., last year but half that amount, 1.8 million kw. The result, of course, was that the last December peak had a margin of 20.9 percent in net dependable capacity as defined by FPC, which is much better than the 18.3 percent margin a year previous.

There is an element of utility operation during wartime that the harbingers of power shortage have always neglected to observe—improved load factor. We had it in the last war and we are having it in this one. The hours use of generating equipment on the average last year exceeded 4,000 hours for the first time.

Fuel efficiency continued to improve with a new low of 1.31 lb. of coal per kilowatt-hour. At the end of the last war it was 3.2 lb.

More than 600,000 new customers were added during the year. The effects of war restrictions on the civilian economy were indicated by a reduced number of small light and power users.

Average residential usage exceeded 1,000 kw.-hr. for the first time, while the average price of a residential kilowatt-hour continued to decrease. It is doubtful if any other commodity going into the American home can show such a record.

Revenue from energy sales was up 7.6 percent to 2.85 billion dollars. Operating expenses increased only 6.3 percent, but a boost of nearly 30 percent in taxes resulted in 4 cents less out of every dollar going to dividends and surplus.

Budgeted for construction expenditures is something over 300 million dollars, the lion's share of which goes for production equipment. Actual expenditures in 1942 were in the neighborhood of 500 millions.

There are now over one million customers on the 797 rural cooperative lines. REA advanced 366 million dollars last year, bringing the mileage up to 378,000. The systems sold something over a billion kilowatt-hours for 47 million dollars.

Manufacturers' Sales

Electrical manufacturers fared quite differently from the utilities, rolling up a sales total of 7 billion dollars, which was a 50 percent increase for the year. This can be compared with the Federal Reserve Board's index of general industrial activity, which is up but 19 percent.

New orders hit a peak about mid-year, falling off rapidly, but showing some tendency to level off in the latter part of the year. Inventories continue to climb and shipments are still lagging behind orders. It looks, however, as though a big bite would be taken out of the backlog before the end of the year.

Engineering

In the operations of the industry almost everything was tinged with war. Construction was restricted because of materials shortages, and even that which was permitted showed the effects of the WPB bare bones policy. Steel gave way to wood wherever possible in line and substation construction and copper began to be replaced by iron for conductors. Old equipment was restored to service and there were resorts to many expedients of the handy-man variety.

While there were few developments of new equipments, engineering talent was devoted as never before to means of getting more power generated and more energy delivered by existing facilities. Raising the gas pressure on hydrogen-cooled units and using higher pressure of gas in a pipe-borne cable were examples of pioneering in this direction. Taking advantage of margins built in by manufacturers, cables were run hotter, open wire copper carried higher currents without annealing, cooling means for transformers were combined and intensified and generators carried more kilowatt loads where capacitor banks relieved them of reactive duty.

More stress was placed on scheduling for maintenance and overhaul and more attention was given to the protective devices.

Load Service

In the commercial field the manufacture of most of the residential load-building devices came to an end during the first half of the year and the whole aspect of commercial operations was altered. The first trend was toward telling the customer how to keep appliances in good order. Then as gasoline and rubber became restricted customers were taught how to replace fuses. Food shortages loomed up and the utilities engaged in nutrition activities.

The greatest effect of the rubber and gasoline shortage lay in the change in billing practices. There was a strong trend toward bi- and tri-monthly meter readings, with some companies going to bi-monthly billing. Service calls were reduced and in several instances free servicing was discontinued. Likewise, meter inspections were lengthened out.

Power salesmen continued to find sub-contracts for small customers. New contracts offered new problems because of the probable temporary character of the load and the size of individual loads in other instances.

War Regulation

War regulation of utility operations was mostly in the nature of further refinements of restrictions. The most radical change was L-94, which defined power shortage areas and placed the responsibility for regional integration of power facilities strictly up to the utilities. As a result, some sort of pooling measures were taken voluntarily in almost every section of the country. Well over a million kilowatts of capacity formerly in reserve became dependable.

As the year progressed, further and further restrictive orders on the use of materials were issued by WPB. Numbers of types and sizes of many commodities were greatly shortened.

The most startling substitute was silver for copper in buses for the new war plants—100,000 tons of it. Synthetic jewels for meters, galvanized steel for copper wire, wood for steel are among the other more notable substitutes.

Priorities became more and more meaningless for non-direct war need. Allocations were reduced for generating equipment and for line extension work. Inventories were surveyed to see how they could be reduced by sharing with others.

As supply of materials became shorter more emphasis was placed on salvage and scrap. The utilities about doubled their previous year scrap collection.

Naturally, the material situation had an effect upon regulatory codes. The National Electrical Code returned to 1937 on rubber-covered wire, gave more latitude to use of bare neutral and, in general, lowered its requirements. ASTM and other standards-making bodies issued or were working on emergency specifications.

No Power Shortage

There were no power shortage areas during the year, although in one or two instances it looked for a while as though a pretty tight situation might develop.

Wartime began on February 9 and helped out to the tune, it has estimated, of more than a million kilowatts. The dimout on the two coastal areas further helped to reduce the peak, although the greatest effect was in reduced energy consumption. It did help to reduce sky glow, which was considered necessary as a protection to coastal shipping, but it also was instrumental in the greatly increased ratio of night-to-daytime driving fatalities. Blackouts were too infrequent to have any major effect. They did, however, demonstrate that in spite of the rapidity of load decline the systems and the operators could take them without any undue difficulty.

The chairman of the Federal Power Commission predicted a shortage for last year, this year and next year. WPB answered by curtailing generating equipment orders by over 4 million kw. It looks as though WPB were right.

There might have been trouble had the water situation been anything like it was the previous year. Fortunately, however, rains were plentiful, ground water back to normal and storage filled. Likewise, there might have been a recurrence of the fuel problem during the winter of 1917-1918, only this time the utilities stocked up with coal beyond any previous record.

And, finally, the process of regional integration added greatly to the kilowatt stockpile.

Public Power

The year saw comparatively few municipal ownership elections. There were, however, several instances where cities or cooperatives purchased local properties as the result of the shrinkage of holding company systems, the largest being San Antonio, Texas. In addition, there were some PUD purchases. On the whole, public ownership made considerable headway during the year, but with less opposition. The troublesome San Francisco situation was tabled for the duration by the city selling the power to a government aluminum plant.

Kentucky finally passed enabling act permitting TVA to sell wholesale to cities. The first Santee-Cooper unit went on the line and the House reversed itself

and voted 4 million dollars for Central Valley project. Funds to the tune of 57 million dollars were asked for eight projects, but as the year wore on WPB was less and less inclined to allow materials for projects that did not have an immediate war necessity. St. Lawrence was finally abandoned for the duration, but the government appropriated the last two privately owned electric utilities in Puerto Rico.

REA co-ops were able to break into New York State for the first time. Their line extension work came to a halt, but there was a substantial increase in area served as the result of numerous purchases of private properties or lines.

SEC

Administration of the Holding Company Act moved rapidly forward into its final stages. Very few properties were ordered cut off from the parent company, but a large number of voluntary changes were made. Some of the larger holding companies took different phases of SEC administration into court for final determination. Considerable emphasis was placed by SEC during the year on financial reorganization, even of the operating companies. Its order in the Jacksonville Gas case, if upheld by the Supreme Court, will be a new basic regulation for the industry.

While some of the orphans were purchased with public funds, others were absorbed by neighboring utilities. In fact, there was more of this than was commonly realized.

Legal

Several very important legal decisions were handed down during the year, the most important being that which substituted for Smythe vs. Ames famous fair value rule the theory that there is no single formula for rate making. The outcome has been that prudent investment has since become the single formula in a growing number of valuation proceedings. The right to condemn private utilities for public use was upheld, but a federal court denied the authority of the government to expropriate private companies in Puerto Rico under the Lanham Act. By refusing to hear an appeal, the Supreme Court affirmed the ruling that FPC lacked power to fix interstate wholesale power rates. It also refused to require a company to accept a 1942 water power license from FPC without trial. The commission was upheld in the appellate courts on two decisions, the final adjudication of which will greatly influence the future course of the industry: In the Louisville case, write-ups, no matter how incurred, may be ordered charged to surplus and in the Hartford case it is the end use and not the intermediate steps that determines interstate traffic.

Associations

The Council of Electric Operating Companies was formed to extend cooperation with government in the war effort. American Public Power Association opened offices in Washington and National Rural Electric Cooperatives Association was formed to extend the scope of REA operations, following the organization of several state associations of cooperatives.

Labor

Utility employees in 86 job classifications were listed essential to the war effort and required to get a release before enlisting. Women began to drift into male occupations, and some 60 jobs were noted as suitable for women.

There were no strikes that brought any stoppage of service. Twenty-four independent utility unions organized a national group. REA and IBEW negotiated a no-strike covenant which recognized desirable wage schedules.

Rates

Several interesting angles to rate regulation came up during the year. Despite the fact that most rates were state-regulated, the Office of Price Administration sought to intervene in cases where increases were sought. In most instances the cases were dropped, but in the Washington Gas case an increase was granted despite OPA, and the matter was taken to court. An amendment to the act gave OPA the right to intervene in these cases and required a 30-day notice prior to any general raise. Wisconsin Commission ruled that rates should be frozen for the duration.

So-called excess earnings as defined in the income tax act brought a demand from Detroit that they be refunded to consumers rather than pay out the money in taxes. Likewise, the Arkansas Commission ordered a refund of virtually the same amount as the excess earnings tax. FPC for rate making froze taxes at 1940 levels, ruling that increased war taxes may not be passed on to customers.

FPC was given authority later in the year to review all rates for power to war plants and to renegotiate the rate where advisable.

In a number of instances FPC ordered utilities to charge off large sums in excess of prudent historic investment. Mostly these were ordered charged to earned surplus, although in certain instances part of the write-downs were permitted to be amortized.

Kentucky finally agreed to exempt from state regulation cities buying TVA power for resale.

Taxes

New war taxes which increased utility ratio to 24.1 cents per dollar of revenue might have been worse. A late amendment permitted utilities to deduct preferred dividends in computing surtaxes.

Ohio Supreme Court ruled that co-ops may be assessed for taxation the same as privately owned utilities and Missouri ruled likewise on cities selling outside their borders. Three Tennessee cities filed suits to recover for 1941 taxes on TVA property.

Taken as a whole, the year was not overly harsh on the utility economy. Many changes took place and some new elements of regulation were impressed. These were inevitable. The year 1943 should be much easier to take.

Manufacturers' Output Up 50 Percent

Shortage of raw materials, despite use of substitutes, remains serious — More trained labor is needed — NEMA's war efforts

MAX McGRAW
President National Electrical Manufacturers Association

THE PRODUCTION RECORD established last year by electrical manufacturers—an estimated 50 percent increase over 1941—is a gauge of the industry's earlier conversion to war requirements and its determination to "see it through" to a complete and early victory.

Because the products of our industry are essential both to modern warfare and to the tremendous network of industry, transportation and business that serves the armed forces, electrical manufacturers inevitably were among the first to react to the challenge of the times. In the year which culminated with the dastardly attack on Pearl Harbor the industry had doubled the production total achieved in 1940. The record, therefore, shows a total increase of 150 percent during the past two years, with an indication of a further increase in the coming year, provided the present plant capacity and labor supply continue and the supply of raw materials remains adequate.

The industry's 1942 performance may be said to compare favorably with the Federal Reserve Board Index of Industrial Production, which reveals an estimated increase of 15 percent for 1942 over 1941, with a 25 percent increase in the durable goods field.

Not Enough Materials

The shortage of raw materials continues to be a major problem. As a matter of fact, it may be said that the effect of such shortages has been to act as a "braking" factor upon manufacturers' production.

Every effort has been made to alleviate this condition through the development of many ingenious substitutions for most of the critical materials, notably copper, steel and aluminum. Steel reflectors in lighting equipment have been eliminated by the use of a composition reflector made of non-critical materials. Similarly, the use of copper and brass has been greatly curtailed in the manufacture of wiring devices through limiting the utilization of these materials to current-carrying parts. Fibre materials are also being increasingly employed. Aluminum has been replaced by iron and steel housings in traffic signaling equipment, an important and significant change. In the field of insulating materials substitutions have been made for critical chemicals, and the use of rubber for wire and cable insulations has been extensively reduced through resorting to alternate materials.

Despite the vigor with which the industry attacked the problem of raw materials deficiencies and the high degree of ingenuity that was brought to bear upon the problem, it still must be admitted that the problem remains serious. Shortages have not only threatened production but have also affected production costs. Unavoidably there have been some reductions in the hours of employment, and there have been temporary lay-offs, caused, in some instances, by the shortage of raw materials, and this in turn has tended to make the labor and production problems more difficult.

Manpower, a Problem

Closely allied with this situation is the need for maintaining a sufficient and adequately trained labor force. If the industry is to increase, or even maintain, its present high rate of production, a great deal will depend on the availability of adequate numbers of trained workers and on the recruiting, training and up-grading of untrained workers.

It is to be hoped that the operation of the War Manpower Commission will soon alleviate the problem of increasing turnover of labor. Perhaps the largest single factor in the present situation is the movement of workers from one plant or industry to another, seeking higher wages.

Electrical manufacturers are, of course, training and employing many women to replace men and to add to the labor force. Some companies indicate that they expect in the near future to double the number of women workers they now employ.

During the past two years the National Electrical Manufacturers Association has made every effort to render special wartime services to the degree and extent required of it by both our government and the industry itself. As a liaison agency, NEMA serves government

agencies and electrical manufacturers in the fields of factual statistical information, dissemination of priority orders and assistance on the development of specification and standards. It may be pointed out that much of the collection of statistical data could not be carried on through any other source without greatly increased effort and expense.

During the past year all priority orders of special interest to the industry were reproduced in the form of NEMA War Projects Bulletins and distributed to NEMA members. Meetings of NEMA sections have also offered excellent opportunities to receive and exchange information on priorities, methods of allocation and other problems affecting war production. A staff specialist on priorities is available to assist in discussions and to aid members in Washington contacts. Special meetings for "priorities men" have been organized by NEMA and have been held in New York, Boston, Philadelphia, Chicago, Pittsburgh, Detroit, Milwaukee, St. Louis and other centers.

Substitution Recognitions

In the field of specifications and standards developed at the request of the government the work consists largely of revisions to recognize substitution of non-critical for critical materials rather than the development of new specifications.

The Street and Highway Lighting Safety Bureau, which is sponsored by the Street and Highway Lighting Equipment Section, has recently proposed the installation of safety lighting on essential war roads in an effort to reduce the alarmingly high number of fatal night-time accidents and consequent loss of essential war workers. In making this proposal, it was suggested that much of the street and highway lighting equipment now doing only a "peacetime job" in residential areas could be advantageously transferred to war production localities where traffic is becoming increasingly congested.

An important industry-sponsored program in which electrical manufacturers are directly interested is the new consumer activity of instruction on wiring for wartime service which is being furthered nationally by the National Adequate Wiring Bureau, and locally by more than one hundred leading electric utility companies, electrical leagues and other organizations. The maintenance of electrical service in the home is essential in wartime, as is also the need to reduce to the absolute limit the number of service calls which require manhours and the use of trucks, gasoline and other materials. The rapid public response to this educational service has been most gratifying, and it may be noted in passing that when the war is over millions of home owners and their families will have a much better appreciation of the operation and value to them of the "power path" of home wiring that can provide them with the comforts and conveniences of electrical living.

Another significant development in NEMA during the past year is the recent reorganization of the Electronics Section, with a view to launching a vigorous program designed to utilize to the fullest the almost

unlimited forces of electronic science to win the war and realize the promise of a new and better world after the war. The manufacturers of electronic devices for use in industry are conscious of their twofold responsibility and that they are dealing with a new science which has unbelievable power both to destroy and to build. Today both phases of this power are being widely applied. The program of this group will be directed primarily toward the maximum use of electronics in the production of war weapons and materiel and in actual combat. It will also be directed toward the maximum application of electronic controls in the post-war period, which will help to create a literally different and better world.

The problems of better lighting in both manufacturing and service industries to meet wartime demands for increased production, improved products and greater safety and comfort for workers are being studied by the newly organized Industrial and Commercial Lighting Equipment Section of NEMA. This group is planning to provide a better service to industry and to the war production effort.

After-War Problems

All industry is trying to win the war as quickly as possible. Recognition that industry has done a splendid job is most gratifying. Electrical manufacturers, since they occupy, in a sense, a key position in our national wartime economy, have a tremendous responsibility to do their full share in the nation's war effort. As an industry, we consider it our patriotic duty to look ahead to the post-war period. We therefore are following the lead of our government and, through NEMA, will make every effort to estimate the probable post-war conditions to the end that the transition from war to peace will be effected as quickly and smoothly as possible.

Editorials

S. B. WILLIAMS, *Editor*

REA's Authority to Buy Up Private Utilities

FOR SOME TIME REA cooperatives have been buying up small privately owned properties or lines, sometimes orphans under the Holding Company Act, but often not, under a ruling from the REA legal staff that there was nothing in the REA Act to prevent such purchases. An interesting point is thereby raised—does the absence of limitations give permission?

Up until a month or two ago, these dealings, while increasing in number, were always small, but then the Missouri co-ops became ambitious. They formed a holding co-op to purchase the properties of a company operating in 20 counties in the state—and at once this became a big-time operation.

Regardless of what kind of a decision the Missouri Commission, which has been asked by private companies to prevent the transaction, gives, the courts must sooner or later determine, in the absence of permissive legislation, the authority of REA to lend money for purchase of utility properties. Already Representative Rankin has introduced a bill to give this permission.

If by legal decision or by legislation REA receives this authority the public power advocates will have achieved what has been denied them before—the use of federal funds without restriction, except as to total amount and size of community, for nation-wide purchase of privately owned utilities.

While the present bill would limit REA funds to $100,000,000 a year, there is nothing to prevent a later bill from increasing that amount still further or increasing the size of the community that might be taken over. The net result would be the ringing around of all utility systems with a publicly owned rural system.

REA was started to take electricity to unserved rural areas, with emphasis on unserved. If the presently offered bill is enacted, how much of the funds of REA will go to extend service and how much to acquire private systems? The pressure of the public ownership bloc, we suspect, will be too great for any REA administration to resist.

The Rural Electrification Administration has done a splendid job in opening new rural territory to central service. As the unserved territory becomes thinner it is probably the only agency that can bring electric service to the sparsely settled areas. How far we shall go in serving such widely scattered farms is a matter of national policy—but in any event it should be a policy of bringing electric service to people who otherwise could not have it. Such a policy can never jibe with lending money to buy into areas already receiving service.

Six Billion Kilowatt-Hours Saved for War

THERE is one column in the table in the article showing the distribution (page 91) of generated energy that should have more attention. It tells a remarkable story. We refer to the column entitled "losses."

Up until six years ago about one out of every six kilowatt-hours generated was lost. With plenty of generating capacity and reserve this was not particularly worrisome. Then something happened and the loss ratio began to fall until last year, when less than one in seven kilowatt-hours was lost.

If the former one-in-six ratio had existed last year, an additional 6 billion kilowatt-hours less would have been required to take care of losses. That at the average load factor of the industry would have equalled the output from one-and-one-half million kilowatts of capacity, which for three years would about equal the new generating equipment lopped off by WPB for about the same period.

The money side also is interesting, because at the average revenue per kilowatt-hour for all energy these six billion kilowatt-hours would bring in something over one hundred million dollars and, as the comedians say, that isn't hay.

At this time, however, the most important thing is the contribution of better engineering to the service of war. Reduction of waste means more energy to carry load without adding to the burden on raw materials, or machine production labor or shop space.

Fuel Cooperation

UTILITY EMPLOYEES can well be proud of the industry in which they work because of its contributions to the war effort. Not only has there been enough energy and on time for the production of war goods, but the manner in which the industry has cooperated with federal agencies to soften the impact of war on the civilian life has been equally all out.

In the matter of coal, for instance, the electric utilities entered their peak period with supplies for nearly four months. Ordinarily, with no coal strike in the offing, two months would have been ample. No other industry was as foresighted, according to official reports.

And four months' supply now would be the same as eight months' supply only seven years ago. It wasn't just the buying of the coal and paying for it—it was the physical storage. How and where? However, it was

done and done early, thereby relieving the railroads as well as assuring the supply of energy.

Also, Washington called for conversion from oil to coal wherever possible. The electric utilities, in spite of the greater demand for energy, reduced oil usage by 3⅔ million barrels, or by almost one-fifth.

These things didn't just happen any more than the adequate supply of power. They are the result of definite planned cooperation on the part of management. This will come as a surprise to a great many employees—we wonder how much more of a surprise it would be to the public, which is forever hearing about the seamy side of the power companies.

Is the Puerto Rican Seizure What We Are Fighting For?

IT IS SOMETIMES very difficult to decide what war and for what victory we are supposed to be fighting as a united nation. In past wars there was a unity of purpose, but this time, when Administration forces use the war for purposes which seem to be exactly opposite to what we are supposed to be fighting for, we sometimes wonder.

The Puerto Rican power reseizure is a case in point. Last summer the government, under the Lanham Act, expropriated the San Juan and Mayaguez properties, the last privately owned electric utilities on the island. A federal court declared the seizure illegal and ordered the properties returned, whereupon the government reseized the properties, this time under the second war powers act.

The action was said to be taken to insure that there be adequate power for the war plant in Puerto Rico. On the face of it, that looks innocent enough, but these properties were interconnected with the Island Water Resources Authority system and the situation could have been handled just as well through integration as through common ownership. In the States WPB order L-94 provides for just such integration as existed in Puerto Rico to take care of any power shortage area.

We wonder why L-94 wasn't applied last summer in Puerto Rico, because it had been in effect nearly two months when the first seizure occurred. WPB was advised about the situation. Did it duck because it was too hot a potato to handle, or did it believe Puerto Rico was outside its jurisdiction?

And the second time the properties were seized, did the same power shortage threat exist? Was any survey made? Did the President submit the problem to the power branch of WPB? Obviously he didn't, because L-94 was not invoked. Was the President afraid that WPB would give him an answer that his henchmen wouldn't like?

It is a strange thing that shortly before the seizure all street lighting served by oil-burning utilities was banned, but was restored not long after the seizure because of service from hydro. Couldn't the hydro have come to the rescue earlier? The Water Resources Authority was asked to fulfill its part of the interconnection agreement, but refused. Did it do this in order to force a situation that would give an excuse for seizure?

This wasn't a case where the people of Puerto Rico voted for public ownership. In spite of Governor Tugwell's hurried announcement to them last June that "these properties are now yours," he had had no public demand for them. Any way you look at it, it is but another one of those socialistic programs forced upon an unhappy people.

And why did the seizure take place when it did—at the very beginning of the rainy season? The Island had gone through all the worst, and from that time on there would be an abundance of water. Obviously, the only answer that one can see is that the Administration was determined on seizure, and when the private companies didn't break under the worst conditions, they had to be seized before Nature came to their rescue.

If the government's own document L-94 is good enough for an extensive operation like that in any area in the States, surely it is good enough for Puerto Rico. If the Administration is honestly fighting this war for the preservation of democratic principles, then we suggest that it reject the undemocratic, un-American, unfair expropriation of these two Puerto Rican properties and restore them to their rightful owners. Then perhaps we can be less suspicious of double-talk when the President bids us unite for victory against the common foe.

How Much Energy Does the Farmer Buy?

TWO SETS OF DATA on rural use of energy as presented in this issue are apt to be puzzling unless one examines them carefully. The data reported under the headings of customers, sales and revenue refer to customers so classified by rates under the standard accounting system and do not include REA customers. They are included in the residential column. The special REA data refer only to customers taking service from rural cooperative lines.

In neither case do we get a true picture of farm load or usage. In the first instance there are excluded farm customers who pay the standard urban rate and there are included non-farm customers located in rural areas who pay the rural rate. In the REA data are included, in addition to farmers, small community dwellers, commercial and industrial accounts and such large users as airfields, cantonments and this year an aluminum plant.

For that reason one could not by taking either data arrive at any accurate figures either for the total number of farm customers or for the average farm usage of electrical energy, although it is plainly evident that the usage per customer in rural districts is growing rapidly.

Because this market is rapidly increasing and should be expected to expand greatly after the war, it would be very much worth while to have some reliable annual data on over-all farm consumption of energy as well as the actual number of electrified farms.

Washington Comment

GEORGE E. DOYING, Jr., Washington Correspondent

Nugent Post-War Plan Finds Washington Shy

WASHINGTON doesn't really know quite what to do with Rolf Nugent's plan for "installment-selling-in-reverse." It's a little bit like an abandoned infant on a bachelor's doorstep!

Nugent's proposal for siphoning off excess consumer income during the war and providing, with funds thus collected, a foundaton for a post-war durable goods market, isn't actually a government program. It's popularly associated with the Office of Price Administration, where Nugent is a special adviser from his consumer credit post with Russell Sage Foundation, and was formally unveiled with the blessing of OPA Chief Henderson. But Henderson is leaving and the Office of War Information has taken pains to call it "simply a proposal under discussion at OPA . . . which has not received the approval of the government."

As a result, the scheme may be allowed to pass quietly out of the picture—if it will. If it won't, there is certain to be acrimonious debate before anything resembling the outline of Nugent's 120-page booklet (limited number of copies available at OPA) is put into effect.

Details of Plan

In a nutshell, the plan calls for sales of special government certificates, the money to apply at $1.10 to the dollar on the purchase of designated articles after the war. Autos, pianos, refrigerators and heating systems are proposed to start with, but others would be added—certainly ranges and kitchen remodeling units.

Certificate holders would get a priority on post-war merchandise in the order in which they buy now, and there would be no "free" market until all the certificates had been called for redemption. Prices quoted now would only be approximate and the holder could, by sacrificing the 10 percent appreciation in value for merchandise, get his cash back.

A Post-War Delivery Corporation set up as a subsidiary of the Federal Reserve Board would supervise workings of the plan. Sales would be made by established dealers, and finance companies would keep the books on installment contracts, each getting a modest commission from the Treasury. Utilities would be enlisted to collect money, getting 7 cents an item for the job, also from the Treasury. The 10 percent appreciation would be split between manufacturer and dealer, 30-70.

Morgenthau Opposed

This current version is the evolutionary result of six months of rewriting and revising by Nugent in an effort to overcome objections raised both inside and outside government. Only trouble is that where one objection grew before, two flourish now.

As Nugent sees it, his program takes money away from civilians at a time when they have too much and in a manner with sales appeal, helps keep dealers and finance companies alive during the war, provides the Treasury with funds for war financing. After the armistice, there is a backlog of orders upon which to start production of peacetime goods in an orderly fashion.

General agreement with his philosophy is shared by the Federal Reserve Board, which Nugent has picked to administer his plan to duck the charge that OPA wants to live beyond the war. Not so, however, with Secretary of the Treasury Morgenthau, who is openly and adamant in opposition. Morgenthau fears the merchandise bonds would compete with his war bond sales campaign, that it would cost more than borrowings through normal channels. But this isn't the first time that Morgenthau and FRB, have clashed on government fiscal-economics!

Morgenthau also has raised the point that the wartime purchases would be unfair to service men, enabling workers with inflated war incomes to grab most of the certificates. This is important to utilities in view of the fact that the plan would earmark deliveries of the first several billion dollars worth of goods and the likelihood that a larger proportion of the soldiers will be wanting new, rather than replacement, items. Nugent's remedy is a scale of much lower installment payments for those in service.

It is in the post-war aspects of the proposal, however, that the most heated debate has been stirred up. In the government there is the fear that a huge sales campaign for post-war buying—Nugent estimates first year sales at $3,000,000,000, second and third years at $4,500,000,000—would distract a lot of effort from the winning of the war. From business groups articulate in Washington, particularly the auto dealers and the finance companies, there comes the more direct question: Aren't we simply doing business now which will create an air pocket later while the earmarked deliveries are made?

Government Control Feared

Probably the greatest controversy revolves around the implied necessity in the Nugent plan for a continuation after the war of wartime priority and price controls. Wouldn't an allocation of raw materials be needed to synchronize with the calling for redemption of merchandise certificates? Wouldn't the government feel obliged to regulate prices of articles now sold at approximate figures?

Not all business is opposed to the idea of post-war selling now, however; the opposition from this quarter is more to a government-manipulated program. An affirmative note has come from Henry J. Kaiser, the industrialist, who proposes that industry itself take the leadership now in selling a post-war prosperity by building up a lacklog of orders.

A pioneering step in this direction is being undertaken by the Hartford Electric Light Company with its deferred delivery purchase plan for refrigerators, ranges and hot water heaters. Washington hasn't yet caught up with the Hartford plan, but a good many officials concede that its spread would react against the Nugent plan, and against "necessary-by-default" post-war bureaucratic controls in general.

Krug Named Power Czar New WPB Office Created

J. A. Krug, former chief of WPB's power branch, late this week was named the nation's wartime power czar.

Krug was appointed by WPB Chairman Donald Nelson to be Director of a newly-established Office of Power Director. In this capacity he is to have all that he needs of Nelson's sweeping authority to exercise complete supervision of the wartime role of power, gas, water and communications.

The action reflects a recognition of the vital importance of power in the war picture. Establishment of the Office elevates electric power to a parity with rubber, high octane gasoline, planes and ships in the war agency structure.

Establishment of the Office also is seen as Nelson's solution to disputes over power administration and policy with the Federal Power Commission and the Interior Department. Inasmuch as Nelson's disputes with FPC had been taken to the White House (ELECTRICAL WORLD, Jan. 9, page 52), it is assumed in Washington that the WPB Chairman's action has Presidential blessing. Because Krug had a major part in forming WPB's power policies, his new assignment insures their continuance.

Krug's delegation of authority is complete enough to make him independent of the "horizontal" segments of WPB, such as the Facilities Board, Materials Redistribution Division, etc. Nelson's authority, which Krug inherits, supercedes that of all other government agencies on matters involving war production. On policy matters, Krug reports only to Nelson and on administrative problems directly to Vice Chairman Ferdinand Eberstadt.

The Office of Power Director will be delegated a "claimant agency"—one of about a dozen—in the Controlled Materials setup. As such it will have membership on the WPB Requirements Committee and will get a direct allocation of controlled materials—copper, steel and aluminum—for necessary utility construction and maintenance. Before, WPB's Power Division was one of many essential civilian industries which were to share the CMP allotments made to the Civilian Supply Division.

Krug will issue his own regulations and orders on priorities, allocations and rationing subject only to the overall strategy program determinations of the Requirements Committee and the overall strategy production policies of WPB Vice Chairman Charles E. Wilson.

The new Power Director plans no major alterations either in personnel or policies of the Power Division and the Communications Equipment Division, both of which are absorbed. Existing priorities regulations administered by these divisions will continue in effect. Herbert S. Marks, who has been acting director of the Power Division since last summer when Krug was put in charge of all priorities, becomes the legal counsel for the Power Director. Leighton Peebles, director of the Communications Equipment Division, is expected to remain in charge of that phase of the new administration.

NEWS OF THE WEEK

Constitutionality of "Death Sentence" Upheld by Court

Second Circuit Court of Appeals affirms SEC orders on divestment of North American Co. properties and their retention of single system of Union Electric Co. of Missouri

The constitutionality of the "death sentence" clause of the Public Utility Holding Company Act of 1935 was upheld for the first time recently in a unanimous decision by the U. S. Circuit Court of Appeals for the Second Circuit, denying the petition of the North American Co. for a review of two orders of the Securities and Exchange Commission, issued under Section 11 (b) (1) of the act. The decision, which may be appealed to the U. S. Supreme Court, would compel North American to divest itself of all interest in some 80 properties and confine its activities to a single system, the Union Electric Co. of Missouri and subsidiaries.

Rules on Divestment

The Circuit Court of Appeals decision, handed down by Judges A. N. Hand, Thomas W. Swan and Harrie B. Chase, besides holding in favor of the SEC in the matter of geographical integration of the North American system, also upheld the commission in denying the company an opportunity to present further arguments concerning the power of the agency to designate the particular system to be retained. The utility had held that prior to forced divestment the SEC had to make studies on geographic integration and publish its recommendations as required by Section 30 of the act. The court found, however, that Section 30 should be considered as an administrative direction to the commission, rather than as a condition precedent to instituting proceedings under Section 11 (b) (1).

The court decided that the SEC had made the selection of the Union Electric Co. system as the only one to be retained by North American only after the holding company had declined to designate which of several subsidiary systems it preferred to retain (ELECTRICAL WORLD, June 20, 1942, page 6; July 4, 1942, page 4; November 7, 1942, page 9). Of these other subsidiaries, North American had held that it could not determine whether the St. Louis, Cleveland or Milwaukee systems will be most marketable, and that it should be permitted to make a final selection at any time within the period allowed by the commission to comply with the order. The court held, however, that the statute contemplated no such deferment of selection. North American had contended further that more than one system might be retained under the provisions of the integration clause which would result in economies from group operation. This claim was denied by the commission and the court upheld them on the basis that the commission's staff of experts was better able to judge whether economies were achieved by centralized control.

DIMMING ALL TYPES OF STREET LAMP —Distribution department forces on the New England Power System are busy these days carrying out Army orders to shield many thousands of street lights in the defined areas of the widespread territory served so that skyglow will be minimized. In equipping this ornamental lamp unit for the duration so that it will be of no aid or comfort to enemies, the system's safety practices are carefully observed as shown at the ladder's foot.

Deny Destruction of Values

"The petitioner's argument," the court declared on the question of constitutionality, "comes down to the contention that the retention of securities, which Section 11 (b) (1) assumes to regulate, is a purely intrastate matter and beyond Congressional power.

"That the power of Congress to regulate interstate commerce extends to regulation through legislative action of activities intrastate which have a substantial effect on the commerce cannot be, and is not, disputed." The court pointed out in this connection that the Holding Company Act provides for the exemption of any holding company whose activities are predominantly intrastate in character, and added that North American had never claimed exemption under this section.

The second constitutional argument North American had advanced concerned an alleged violation of the Fifth Amendment, which guarantees the right

WING DAM GOES OUT—During high water of the Willamette River at Oregon City, Ore., on January 2, 150 ft. of the rock-fill, timber-crib wing dam belonging to the Portland General Electric Co. was washed out. The river at that time registered the fourth highest water on record. At the same time a million feet of logs broke loose above the dam and were the immediate cause of the failure. This caused a temporary shut-down in operation of the Hawley Pulp & Paper Co. plant, but did not immediately affect operation of the P.G. & E. 4,890-kw. water power plant on the east side of the river

of property against anything but the "due process of law." On this argument the court held as follows:

"The object sought by the statute (Section 11 (b) (1) of the Holding Company Act) under consideration is the elimination of abuses in the public utility holding company field. It is argued that the divestment of securities required by Section 11 is not a reasonable means to that end because it will involve a destruction of values. We do not think the argument can prevail.

"Congress did not think it could accomplish its object solely by regulation of future transactions, although many of the provisions of the act apply only to them. To eliminate existing conditions which adversely affect the public interest Congress considered it necessary to announce Section 11. The means selected are clearly adapted to the end in view.

"The wisdom of the legislation and the appropriateness of the remedy chosen is not the concern of the courts. Compelling the holding company to dispose of its security is not the same as condemning private property for public use without paying just compensation. Under Section 11 (c) the petitioner is given a year within which to comply with the order and may, on proper showing, obtain an additional period not exceeding one year. If divestment can be effected by distribution in kind there may be no loss of values.

"If, petitioner contends, such distribution will be impossible and a liquidation by sale become necessary, the process may be canceled to its common-stock holders, but we cannot say that the remedy selected by Congress is so unreasonable, arbitrary or capricious as to constitute taking property without due process."

Other Cases Pending

News of the decision of the Appellate Court on the North American case caused considerable speculation in holding company circles as to the future disposition of similar cases which are up for review. United Gas Improvement Co.'s case, requesting a review of SEC orders on geographic integration, was argued before the Third Circuit Court of Appeals and decision is being awaited. In the meantime the company recently decided to liquidate (ELECTRICAL WORLD, January 2, 1943, page 6). American Power & Light Co. and Electric Power & Light Co., sub-holding units in the Electric Bond & Share Co. system, have actions pending on "death sentence" orders in the First Circuit Court of Appeals at Boston. Engineers Public Service Co. is challenging the SEC in Washington, D. C., to test the constitutionality of the Holding Company Act on "broad" grounds. Commonwealth & Southern Corp. has filed a brief in Philadelphia's Circuit Court of Appeals attacking the powers of the commission to issue corporate simplification orders under Section 11 (b) (2) of the Holding Company Act. Here the question to be determined is whether the SEC can alter the rights of the security holders without their consent and their right to be heard. Indications point to these cases being pushed to conclusion.

•

Congress Gets New TVA Amendment

Bills to incorporate the Cumberland River basin into the domain of the Tennessee Valley Authority and to allow the city of Anchorage, Alaska, to float a $1,250,000 bond issue for purchase of the Anchorage Light & Power Co., Inc., • were laid before the 78th Congress during its first two weeks.

The TVA amendment, sponsored by Rep. J. Percy Priest, Tennessee Democrat, was referred to the military affairs committee, headed by Rep. Andrew Jackson May, Kentucky Democrat, who is opposed to the move. A similar measuse introduced last session by Priest spent nearly two years in May's committee without being reported.

Dimond Sponsors Alaskan Bill

The Alaskan bill was sponsored by Delegate Anthony J. Dimond, whose office described it as enabling legislation for a move already agreed upon. The bill was introduced a year ago and was favorably reported out of the territories committee last December 14, too late for action at that session. Little opposition was expected in view of favorable reports by the Budget Bureau and Interior Secretary Harold L. Ickes. Principal stockholder of the company is reported anxious to sell. The act provides that not more than $1,000,000 may be paid for the property. Remainder may be used for improvements. The 30-year land issue is dependent on a local referendum. Priest's TVA amendment calls for a "comprehensive survey" by TVA directors of the Cumberland basin. On the basis of this survey, a unified plan for development of river and basin resources shall be made a part of the TVA development program.

The amendment also provides that none of its provisions shall interfere with construction of dams or projects now underway on the river under supervision of the Corps of Engineers. The Engineers' reluctance to lose authority over the river was believed one of the reasons for the bill's failure last session.

•

Repeals City Plant Law

Middletown, Ohio, City Commission has repealed legislation for the construction of a $1,800,000 municipal light plant and approved a new contract with the Cincinnati Gas & Electric Co.

Supreme Court Orders Utility Dynamiting Probe

Five-to-three decision holds that National Labor Relations Board must inquire into charges of terrorism by union in case of Indiana & Michigan Electric Co.

In a five-to-three decision, the U. S. Supreme Court last week ordered the National Labor Relations Board to reopen the labor dispute between the Indiana & Michigan Electric Co. and Local B-9 of the International Brotherhood of Electrical Workers (A.F.L.) and hear evidence as to alleged terroristic acts committed by the union to intimidate the company while the dispute was in progress. The NLRB had refused to take the evidence and had ordered the company to withdraw all recognition from the Michiana Electrical Utilities Workers Association, an unaffiliated union. The company was further directed to cease and desist from interfering with employees' organizing rights.

History of Case

Justice Jackson wrote the majority opinion of the court, with Justices Black, Douglas and Murphy dissenting on the grounds that a desire to punish terroristic acts does not justify a failure to protect other innocent employees in their desire to achieve collective bargaining rights.

A brief history of the case shows that on November 12, 1938, Samuel Guy, business manager of Local B-9, filed charges of unfair labor practices on the part of the utility with the NLRB. The board then issued a complaint and set November 28 for a hearing. On November 23 Indiana & Michigan filed its answer to the complaint.

The following day cables at the South Bend substation of the company were dynamited.

In the following year the utility filed exceptions to an intermediate report of the NLRB's trial examiner "recommending generally against the company." That was on September 1, 1939. From then on, up to and including November 23, a succession of terroristic acts occurred—transmission line towers were dynamited on five different occasions and transmission line poles were sawed off in another. Meantime, on October 17, NLRB set November 9 for hearing on the company's exceptions. On February 1 John R. Marks, assistant business manager of the local, and four other members were arrested and charged with the crimes. Three of them were subsequently convicted and sent to jail on the confessions of the three members that they had been paid by Marks to commit the depredations. On February 19, 1940, the company asked a reopening of the case.

Justice Jackson's strongly worded opinion condemned the use of violence in the settling of labor disputes.

"The process of presenting cases to it (the NLRB)," he said, "must be kept free from forces generating bias or intimidation. Dynamiting or display of force by either party has no place in the procedures which lead to reasoned judgment. The influence of lawless force directed toward parties or witnesses to proceedings during their pendency is so sinister and undermining of the process of adjudication itself that no court should regard it with indifference or shelter it from exposure and inquiry.

"The remedies of law are the substitutes for violence, and it is proper that courts and administrative bodies so employ their discretion as to dispel any belief that use of dynamite will advance legal remedies."

Justice Black wrote the dissenting opinion, which took the view that a desire to punish dynamiters does not justify a failure to protect respondent's employees, innocent of wrongdoing, in their freedom to bargain collectively. "This freedom is their legal right," the opinion said, "and crime by some of them cannot justify the company in destroying the freedom of all, or even a few of them . . ."

•

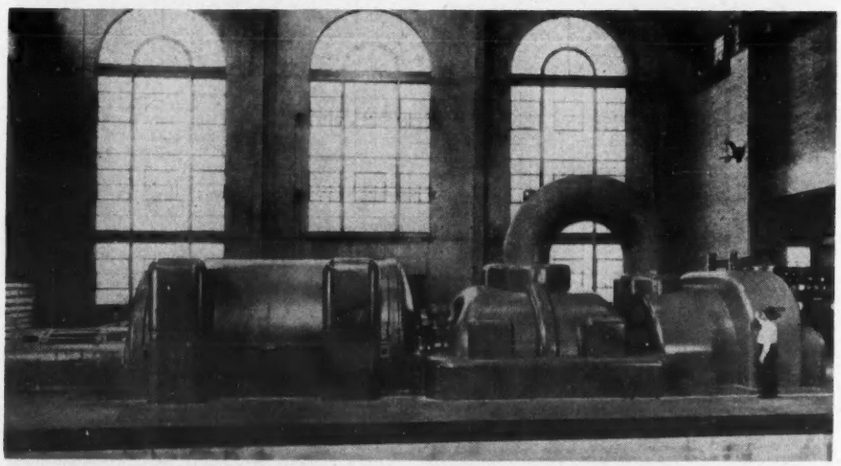
FPC Issues Form on U. S. Power Contracts

Federal Power Commission has developed a "preliminary report" form to be used by federal war agency power procurement officers to outline details and terms of government power contracts pursuant to the President's directive of October 22 (ELECTRICAL WORLD, December 5, 1942, page 3 and October 31, 1942, page 82).

Data supplied from this questionnaire are to be used by FPC in determining the "cheapest source" of energy for government war projects. It is anticipated at FPC that utilities frequently will be asked to help the procurement officers in preparation of some of the required information.

The form asks for the connected load for lighting, motors, electric furnaces and "other." It also asks for the initial power requirements in terms of maximum demand and monthly consumption and for ultimate requirements in terms of maximum demand, average monthly consumption, power factor at maximum demand and average monthly power factor.

Separate exhibits are called for showing location of the project in relation to existing power supply facilities, the nature of existing and proposed power supply facilities and their ownership, description and cost of new facilities required, proposed rates or standard rate schedule and principal provisions of any "contract offered or discussed (*e.g.*, minimum bill, financing of special investment, term, etc.)."



BIG MACHINE WILL SOON BE DWARFED—Hydrogen-cooled 50,000-kw., 3,600-r.p.m., tandem-compound, double-flow turbo-generator is considered large today, according to Westinghouse engineers. But this big one will be superseded when a 3,600-r.p.m., 75,000-kw. unit, at present in the design stage, is constructed

Power Pool Testifies on Standby Service Record

Ark-La cooperative's 84-hour outage to Lake Catherine plant would have resulted in 15,000,000-pound aluminum loss, C. S. Lynch reports — Public power issue raised

Because the Southwest power pool instantly assumed the full power load at the Lake Catherine aluminum plant in Arkansas on December 26, when the federally financed, REA-sponsored Ark-La coop line to the plant went out of service, as much as 15,000,000 pounds of high-grade aluminum was saved for the war effort. This testimony was given by Frank M. Wilkes, president of the Southwestern Gas & Electric Co., when the Federal Power Commission resumed its hearing in Little Rock, January 14, into rates charged under the intercompany agreement by which the pool was formed. (ELECTRICAL WORLD, December 26, 1942, page 55; January 2, page 5; January 9, page 52).

Question Outage Charges

Mr. Wilkes introduced in evidence a copy of a letter to the Defense Plant Corporation from C. S. Lynch, executive vice-president of the Arkansas Power & Light Co. and chairman of the pool's operating committee. The letter accompanied a bill for $206,758 for partial service to the aluminum plant in December, and asked the DPC to determine how the remainder of the bill, covering service during the 84 hours in which the Ark-La line was out of service, should be figured. The power pool has a contract for 65,000 kw. of power for the aluminum plant. Since it was signed on December 16, 1941, the plant's power requirements have not come up to estimates and this full amount had not been required up to the time of the Ark-La outage. The power company, prior to the outage, had submitted to DPC a new contract by which the demand would be reduced to 40,000 kw. for a two-year period. It was the purpose of Mr. Lynch's letter to determine whether the remainder of the December bill, during the time of the outage, should be figured on the original contract or the proposed one.

Mr. Lynch was the second witness on the stand when the hearing, which was recessed during the holidays, was resumed. The first witness was C. Hamilton Moses, president of the Arkansas Power & Light Co., who was called for cross-examination by Lambert McAllister, attorney for the FPC, who is conducting the hearing before Chief Trial Examiner Frank A. Hampton.

In answer to questions by Mr. McAllister, Mr. Moses testified that before the DPC signed a contract with the Ark-La coop for 32,500 kw. of Grand River Dam power for the plant, to be delivered over a 200-mile line the coop had to build to deliver it, the Southwest power pool offered to use its own money to build the lines necessary to get the Grand River Dam power to the plant, and to deliver it without profit to the utilities. He had testified previously that the power companies could have transmitted the power to the aluminum plant by fewer lines and with far less critical materials than Ark-La used for its line, which passes through rough, mountainous country and serves no other load than the aluminum plant.

Mr. Moses further testified on cross-examination that Donald Nelson, WPB chairman, had said he never was informed of the offer of the utilities to tranmit the Grand River power to the plant by the utilities without profit.

On the second day of the resumed hearings Mr. Moses, in response to a question by Mr. McAllister, testified that the Southwest power pool will continue to oppose the development of public power programs in its territory "because it is its patriotic duty to do so." This was the first open mention of public power at the hearing, although opinions had been expressed repeatedly that public vs. private power was one of the major issues involved in the hearing.

Stress Public Power Issue

The public power issue was injected into the hearing several times. Referring to a section in the original contract by the power pool with DPC, in which Arkansas Power & Light offered to transmit public power over its system without profit, Mr. McAllister asked why this provision had been eliminated from a later proposed contract, reducing the demand for the plant by 25,000 kw. Mr. Moses replied that conditions had changed. Mr. McAllister asked if the Arkansas Power & Light Co. would transmit power from the Norfolk Dam, now under construction, over its system with no charge except for line losses. Mr. Moses replied that that would be assuming conditions not now the same as they were at the time the proposed Norfork-Batesville-Little Rock transmission line was under contemplation.

Original cost also was injected at the hearing when efforts of Mr. McAllister to get Mr. Moses to admit a write-up in the company's books met with repeated failure. An exhibit had been introduced showing the pool had $230 a kilowatt invested to serve the aluminum plant.

"For the Arkansas Power & Light Co., is this figure high or low?" Mr. McAllister asked.

"It's low," Mr. Moses replied.

McAllister then asked if, from the utility's standpoint, the $230 per kilowatt figure included some $15,000,000 which the FPC has "or is about to order" out as excess over original cost. Mr. Moses replied that if McAllister was referring to the intangibles shown in the original cost statement filed, the $230 did not include this. He remarked that McAllister was endeavoring to infer a write-up through his line of questioning, when, as a matter of fact, there was none in the company's books.

WELDING FOUNTAIN — Fabricating a massive steel pedestal at the Bentley Weldery, Inc., Syracuse, N. Y., resulted in this spectacular shot recently. As the hot electric arc fuses the metal, the geyser of sparks made an artistic picture for the cameraman (Lincoln Electric Co. photo)

P. G. & E. Project Approved

Final authorization for the Pacific Gas & Electric Co. to complete development of a $25,000,000 electric power project on the Pit River at Bush Bar was recently given by the California Railroad Commission. Immediate completion of the project, with actual generation of power scheduled for late 1943, is contemplated.

National Coop Convention Assails Power Industry

Delegates from more than 400 cooperatives, attending first annual meeting of the National Rural Electric Cooperative Association, hear of gains of coop movement

Convention of the National Rural Electric Cooperative Association at Municipal Auditorium in St. Louis, attended by some 1,000 delegates, representing 427 "dues-paying" members from 45 states, closed Wednesday night with an address on "Power for War-Power for Peace," by Secretary of the Interior Ickes.

While this gathering of REA cooperatives and power districts, supplying electricity to about 1,300,000 farms, is supposedly independent of the Rural Electrification Administration, the meeting had all the earmarks of a political movement. The theme that ran through the sessions seemed to be that the "power trust" is unpatriotic and hampering the war effort, while the work of the Tennessee Valley Authority and various REA cooperatives in behalf of the war effort was played up. For instance, Clyde T. Ellis, executive director of the association and former Arkansas Congressman, in his address entitled "Why We Are Here," repeated the previously denied charge that St. Louis lost several war industries because this district did not have sufficient power, and local rates were exorbitantly high. He specifically blamed this alleged power shortage on the defeat, by Congress, of the Table Rock and Bull Shoals Dams on the White River.

Harry Slattery, REA Administrator, referred to the power lobby as "those buzzards." In reviewing their thirty-year effort to kill the co-operative movement, Mr. Slattery reported that the 800 cooperatives, financed by the REA, are more than $10,000,000 ahead of the repayment schedule of loan contracts, and that in December advanced payments jumped to $1,096,132. He added that the delinquencies of some few associations total less than 1 percent of the amount due the REA from all associations.

In an address on "Let's Electrify Every Farm," Congressman John E. Rankin of Mississippi said: "There is enough water power now going to waste in our navigable streams and their tributaries to electrify every home in America and supply current at rates the consumers can afford to pay. He indicated when the war is over REA will redouble its efforts to place cheap electricity in every farm home. Former Senator George W. Norris, spoke on "Rural Electrification." Messages from President Roosevelt, Vice-President Wallace and Secretary of Agriculture Wickard were read. Eugene Casey, special executive assistant to President Roosevelt, spoke on "REA and Its Role in Peace and War." Senator Richard B. Russell of Georgia spoke on "Rural Electric Co-operative a Weapon for Victory."

Use by the member cooperatives of the recently formed Rural Mutual Fire Insurance Corporation and the Rural Mutual Casualty Insurance Corporation, recently incorporated at Baltimore, was discussed at one of the late sessions.

President Roosevelt's message paid tribute to the work done by the REA and asserted that the electrification of the country's farms under the agency was "one of the lasting achievements of my administration."

"The extension of electric service to a million farms was an important step in preparedness for ultimate victory," the President said. "It represents an extension of what is perhaps the most democratic form of business enterprise, one in which the individual finds his greatest gain through cooperation with his neighbors."

As the strain on the nation's manpower grows, the President added, the country will realize ever more clearly how much the rural electric cooperatives have added to its strength.

•

Light Plants Face Oil Shutdown

A couple of municipal light plants in Long Island towns appeared to be the latest victims of the critical oil shortage in the Eastern states. The Petroleum Administration for War, acting on suggestions of Milo R. Maltbie of the State Public Service Commission, revealed that a proposed shutdown of the plants which use oil to generate electricity was part of a general program to eliminate such operations in the East.

Both communities, Freeport and Rockville Centre, L. I., can be supplied by the Long Island Lighting Co., according to Mr. Maltbie, who said that he had conferred with village officials and found them favorable to converting to coal, using Long Island Lighting's distribution system to maintain service in the interim.

The War Production Board is working closely with PAW in making a survey of diesel oil-burning light and power plants, and also of plants burning oil to generate steam, it was said. Wherever possible, PAW is issuing conversion directives. In some cases, however, if conversion is not practicable, the agency directs a shutdown and the utilization of other sources of power. The town of Bath, N. Y., has already received a five-day notice to show why it should not shut down its oil-generating plant.

JOSHUA HENDY ON THE MOVE—A. J. M. Baker, general manager of the Crocker-Wheeler division; Charles E. Moore, president of the Joshua Hendy Iron Works, and George A. McKenna, general manager of the Pomona-Westco Pump Co., got together for a discussion recently on the occasion of the acquisition of the latter company to the rapidly expanding activities of the West Coast concern

New Bill Would Legalize REA Utility Purchases

Amendment, sponsored by Representative Rankin, follows petition of 14 utilities in Missouri to stop sale of Missouri Electric Power to Sho-Me Power Cooperative

A move to legalize REA purchases of existing privately owned electric utilities is contained in a bill before the House interstate and foreign commerce committee.

The bill, sponsored by Rep. John E. Rankin, Mississippi Democrat, would amend the REA act to allow "acquisition and operation of generating plants, electric transmission and distribution lines or systems in rural areas."

Follows Protest in Missouri

The proposed amendment follows the first organized attempt to halt an REA purchase of a going, privately owned system. Fourteen utilities petitioned the Missouri Public Service Commission last month to halt sale of the 20-county Missouri Electric Power Co. to the Sho-Me Power Cooperative, of Columbia, Mo. (ELECTRICAL WORLD, December 26, 1942, page 59.)

REA loans for purchase of going private companies have expanded enormously during the last two years, particularly since the curtailment of new construction. This program has been based on interpretations of the act by REA attorneys which held that nothing in the act forbade purchase loans and that, in general, the act is sufficiently broad to allow them.

Rankin's bill also would redefine "rural" areas, to which REA operations are confined. Under the present act, a rural area is that part of the United States not included within the boundaries of cities, villages and boroughs having a population in excess of 1,500 inhabitants. Rankin would include as rural area cities, villages and boroughs whose population is 10,000 people or less.

Other Proposals Included

Several other perennial proposals are included in Rankin's bill, (HR 878.) One allows REA to make loans up to $100,000,000 yearly. Another provides that loans shall be for 50 years instead of 25. The third reduces the interest rate from an average rate of the long-term (ten-year or more) federal securities issued during the last preceding fiscal year in which any such securities were sold to the average of all federal obligations issued during the fiscal year preceding the loan. Another permits reduction of interest rates on existing REA loans to the new average.

Under the President's budget submitted for the fiscal year 1943-1944, REA was alloted $30,000,000. During the current fiscal year REA had about $40,000,000 available, $10,000,000 in new money and an unexpended balance of roughly $30,000,000 from its 1941-42 appropriation.

•

Oppose Utility Liquidation Delay

SEC Staff Asks Court Action on North American Light

North American Light & Power Co.'s request for an additional year in which to complete liquidation plans was opposed, during oral argument on the question last week, by SEC's utilities division counsel and a minority stockholders' group. It was recommended instead that liquidation of the company "be completed under the ægis of the U. S. District Court" to enforce immediate compliance with the "death sentence" order. At the conclusion of the hearing the commission took the matter under advisement.

In opposing any further delay in the liquidation of the company, a major sub-holding unit in the North American Co. system, Henry C. Lank, SEC public utility division counsel, said the SEC staff had no quarrel with the rapidity with which the Light & Power management had applied itself to liquidating the company, but charged that the management's decisions had been more in the interests of the parent company than the public security holders. He was joined by Lawrence R. Condon, representing stockholders owning about 5 percent of the preferred stock, who said that expenses in connection with the liquidation, "now ticking on like a taximeter," would be curtailed if the SEC put the matter into the hands of a District Court.

Clayton E. Kline, counsel for North American Light & Power, argued that the commission should retain jurisdiction. If the plea is denied, he pointed out, and the commission took the matter to the District Court to enforce its order (under Section 11 (d) of the Holding Company Act), jurisdiction would pass to the federal court, which would not fulfill the intent of Congress. He told the commission that every effort had been made to comply with the order, but that the situation contained "some difficult and involved problems," including a claim of more than $40,000,000 by Illinois Iowa Power Co. against North American Light & Power, not as yet settled.

The original order against Light & Power was issued December 30, 1941. Subsequently, on October 15, 1942, the company filed a voluntary plan of liquidation under Section 11 (e) of the Holding Company Act. This voluntary plan is still pending before the commission, which has scheduled a hearing for February 2. Mr. Kline noted this fact and said that the commission would not be completing its duties if it intended to resort to court procedure under Section 11 (d) prior to passing on the voluntary plan.

•

Calder Succeeds Kanzler at WPB

Curtis E. Calder, a member of the board of governors of the New York Stock Exchange and president of the American & Foreign Power Co., has succeeded Ernest Kanzler as director general for operations of the WPB.

Mr. Kanzler resigned because of ill health. His departure was seen as the sign of changing times at WPB. Kanzler, first major appointee of Chairman Donald M. Nelson, reportedly felt that since his office was merged with that of program vice-chairman Ferdinand Eberstadt, he no longer had significant policy-making scope.

Mr. Kanzler supervised the automobile industry's conversion to war work a year ago as head of WPB's automotive branch, rising thereafter to the director generalship.

Just previous to Kanzler's resignation, Calder had been appointed deputy director general for industry divisions.

MEETINGS

Previously Listed

American Institute of Electrical Engineers — National Technical Meeting, New York, N. Y., January 25-29. H. H. Henline, secretary, 33 West 39th St., New York, N. Y.

Edison Electric Institute — Accident prevention committee, Hotel Gibson, Cincinnati, Ohio, February 8-9; transmission and distribution committee, Wm. Penn Hotel, Pittsburgh, Pa., February 11-12. Col. H. S. Bennion, managing director, 420 Lexington Ave., New York, N. Y.

American Society for Testing Materials—Committee week and spring meeting, Hotel Statler, Buffalo, N. Y., March 1-6. R. E. Hess, assistant secretary, 260 S. Broad St., Philadelphia, Pa.

Energy Output Remains Static

The energy output figure for the latest week showed only a fractional falling off from last week's figure, close to the four-billion-kw.-hr. mark. For the week ended January 16 the amount of electrical energy distributed by the light and power industry added up to 3,952,479,000 kw.-hr., as compared to the 3,952,587,000 kw.-hr. for the week ended January 9, according to the Edison Electric Institute. The percentage of gain over last year, however, increased from 13.8 percent for the January 9 week to 14.5 percent for the January 16 week.

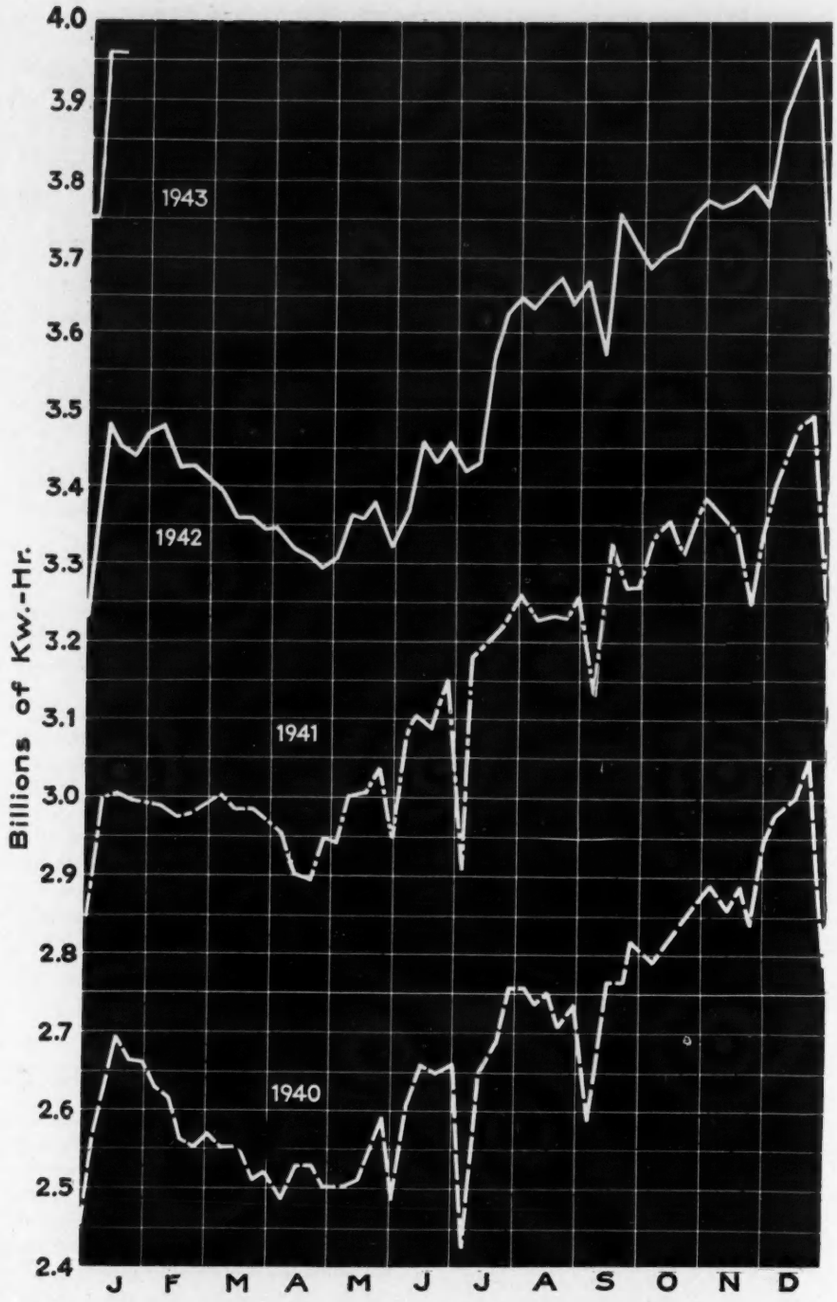
The Pacific Coast, among the country's seven major geographic regions, increased its lead over the '42 figures from 25.0 for the January 9 week to 29.0 for the latest week. The New England, Mid-Atlantic, Central Industrial and Rocky Mountain regions also showed percentage increases. The Southern States dropped back slightly, but are still in second place with a 21.4 percent gain over 1942's corresponding week. The West Central region also showed a small recession from the gain recorded the previous week.

Weekly Output, Millions Kw.-Hr.

1943		1942		1941	
Jan. 16	3,952	Jan. 17	3,450	Jan. 18	3,013
Jan. 9	3,952	Jan. 10	3,472	Jan. 11	3,002
Jan. 2	3,780	Jan. 3	3,289	Jan. 4	2,816
1942		1941		1940	
Dec. 26	3,656	Dec. 27	3,234	Dec. 28	2,757
Dec. 19	3,976	Dec. 20	3,495	Dec. 21	3,052
Dec. 12	3,937	Dec. 13	3,476	Dec. 14	3,003
Dec. 5	3,883	Dec. 6	3,415	Dec. 7	2,974
Nov. 28	3,766	Nov. 29	3,339	Nov. 30	2,932
Nov. 21	3,795	Nov. 22	3,248	Nov. 23	2,839
Nov. 14	3,776	Nov. 15	3,348	Nov. 16	2,870

Percent Change from Previous Year

	Week Ending		
	Jan. 16	Jan. 9	Jan. 2
New England	+ 3.7	+ 2.7	+ 4.4
Mid-Atlantic	+ 7.1	+ 6.3	+ 7.8
Central Industrial	+12.2	+11.6	+11.4
West Central	+12.4	+13.6	+12.4
Southern States	+21.4	+22.7	+25.1
Rocky Mountain	+13.5	+11.4	+11.0
Pacific Coast	+29.0	+25.0	+27.4
Total United States	+14.5	+13.8	+14.9



Floods Noted in Stream Flow Report

According to a report released by the Geological Survey of the U. S. Department of the Interior in collaboration with the Dominion Water and Power Bureau, the country-wide pattern of water conditions in December, 1942, in its general features was about the same as during November.

The particular features noted during that month were: (1) Marked excesses in stream flow in broad areas extending from the central plains to the Atlantic Coast with damaging floods along the Ohio river, Pittsburgh to Louisville and below, in the Tennessee river basin, and in Alabama, Oklahoma, Arkansas, Kansas and Missouri; (2) excessive stream flow in Oregon and Northern California with damaging floods in the Willamette river basin; (3) deficient stream flow in southern Florida, southern Quebec and in northern New England and New Brunswick; (4) subnormal stream flow in the intermountain region from Wyoming south through Arizona with drought conditions prevailing in Arizona; (5) generally favorable ground water stages.

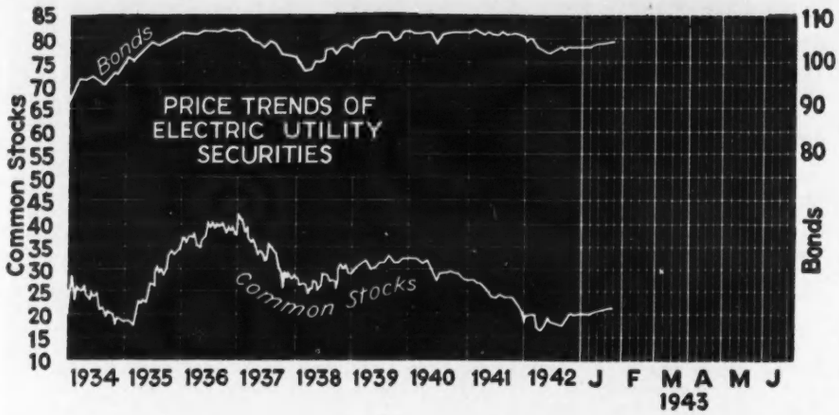
There was a general decrease in the amount of water in storage available for power in Quebec and in the northeastern states, in contrast with a general increase in power storage throughout the southeastern states. In the central west there was a tendency toward increased storage for power needs, increased somewhat in Nebraska and Missouri and decreased seasonally in Minnesota and Wisconsin. Power reservoirs in Manitoba and in western Ontario remain at satisfactory stages, assuring ample water for industrial needs.

•

Output Drops in Canada

Dominion Bureau of Statistics reports that the first decline in monthly Canadian output of central electric stations in 1942 occurred in November, when it totaled 3,180,153,000 kw.-hr., compared with 3,183,982,000 kw.-hr. in November, 1941.

Utility Security Prices Continue to Gain



The upward trend in utility stock prices continued during the past week, the "Electrical World" index advancing to 21.2; previous week, 20.9; last year, 19.7. Bonds also continued to gain, reaching 104.3; last week, 104.1; last year, 104.8

U.G.I., Associated Plan Property Trade

As a further step toward compliance with "death sentence" orders of the Securities and Exchange Commission, officials of the United Gas Improvement Co. and trustees of the Associated Gas & Electric system are planning to exchange two properties it was learned recently. The properties are Erie County Electric Co., owned by U.G.I., and Eastern Shore Public Service Co., a subsidiary of General Gas & Electric Co., an Associated sub-holding unit.

According to the plan, U.G.I. would give to Associated the Erie County Electric, which competes in Erie, Pa., with the Erie Lighting Co., an Associated property. The lines of both companies cross, causing what the SEC calls a "complicated situation." Consummation of the exchange plan would mean the merging of the two companies by Associated.

In exchange, Associated would give to U.G.I. the Eastern Shore Public Service Co., which would be merged by U.G.I. with properties of the Delaware Light & Power Co., which it already owns. Stock of the consolidated company would then be distributed to common-stockholders of U.G.I. as a step in liquidation.

•

SEC Grants Year Stay to Standard

Standard Gas & Electric Co.'s application to the Securities and Exchange Commission for an additional year in which to comply with a divestment order, issued under the provisions of the Holding Company Act, have been granted by the commission. The original order was issued on August 8, 1941 (ELECTRICAL WORLD, August 16, 1941, page 20), and on July 31, 1942, Standard asked for an extension.

Under the divestment order, instituted under Section 11 (b) (1) of the act, Standard Gas & Electric was directed to sever its relationship with the California Oregon Power Co., Oklahoma Gas & Electric Co., Louisville Gas & Electric Co., Northern States Power Co. (Del.), Wisconsin Public Service Co., Pacific Gas & Electric Co. and several other subsidiaries.

•

Approve Vermont Write-Up Disposal

The Federal Power Commission has approved the plan proposed by the Central Vermont Public Service Corp. for the disposition of the amounts of $3,678,581 and $981,127 established as write-ups in the course of reclassifying the company's accounts and determining the value of the company's properties.

As of January 1, 1937, the company's revised original cost studies showed an excess of $4,644,435, or approximately 50 percent of the actual legitimate cost of $9,400,506, made up of $9,353,330 in Account 100.1 (Electric Plant in Service), and $47,175 in Account 100.3 (Construction Work in Progress), according to the commission. At that time Central Vermont established $3,663,308 in Account 100.5 (Electric Plant Acquisition Adjustments). The company proposes to dispose of this amount as well as of an additional $15,273 of plant acquisition adjustments applicable to the period from January 1, 1937, to December 31, 1941, making a total disposition applicable to that account of $3,678,581.

The company's plan conforms with the commission's uniform system of accounts, it was said, provided that the amortization in equal amounts over a period not to exceed 15 years, beginning January 1, 1942, of $2,136,000 (included in the $3,678,581) is made by charges to Account 537 (Miscellaneous Amortization).

•

High Court Backs SEC on Okin Case

The U. S. Supreme Court refused last week to review a decision holding that a Federal District Court lacked jurisdiction to pass on a suit by Samuel Okin, New York attorney, and stockholder in the Electric Bond & Share Co., seeking to enjoin the SEC from preventing the company from purchasing its own preferred stock. The Okin suit was dismissed by New York Federal District Court and the decision upheld by the New York Circut Court of Appeals.

It was the contention of the Department of Justice that a review of the commission's order might be obtained only by filing a suit directly with a Federal Circuit Court. The commission's action in the case at point not having been final, the Justice Department added, the case was not reviewable in any event.

An SEC ruling provides that holding companies may not acquire their own securities except through specified procedure before the commission. Electric Bond & Share, in which Okin owns 9,000 shares of common stock, filed a declaration, stating its intention of using $5,000,000 in cash to buy its outstanding preferred stock. The commission permitted the company to employ $2,000,000 for this purpose, but reserved jurisdiction as to the remainder. Okin argued that the Holding Company Act contains no provision preventing a holding company from buying its own stock with its own cash.

Utility Reports

	Net Income 1942	1941
*American Gas & Electric and subs	$11,462,638	$14,400,338
*Electric Power & Light and subs	8,800,394	7,252,514
*Engineers Pub. Service and subs	4,063,752	4,679,078
*Gulf States Utilities	1,719,768	1,931,186
*Houston Ltg. & Power	2,773,582	2,993,471
*Kansas Gas & Electric	1,494,842	1,466,549
*Louisville Gas & Electric and subs	2,862,079	2,829,443
*Mississippi Power & Light	607,102	429,097
*Northwestern Electric	671,173	477,411
*Pacific Power & Light	773,610	883,965
*Puget Sound Power & Light and subs	3,166,350	2,485,806
*Superior Water, Lt. & Pwr.	106,511	91,823
*Virginia Electric & Pwr.	3,738,391	3,804,601
*Washington Water Power and sub	2,373,333	1,860,586

* Twelve months ended November 30.

TO ELECTRICAL MEN EVERYWHERE

You Can Save Even More Copper than We Can

IN many respects, copper is more valuable than gold. For without it, we, as manufacturers, cannot produce the machines that keep plants humming; without vast amounts of it we cannot produce the electric equipment needed in such large volume by the Army and Navy.

In every G-E plant—in every G-E design office—we are spending thousands of man-hours to the end that not one pound of the "electrical" metal shall be wasted. Our engineers in the field have a similar objective—to help you save copper in the *application* of electric equipment.

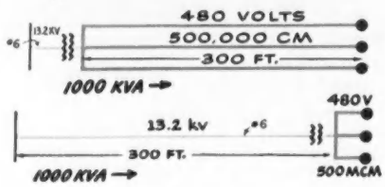
For many months we have been making available to everyone the more significant, the most useful facts pertaining to copper conservation. Witness the several publications shown here, and described further in the following pages.

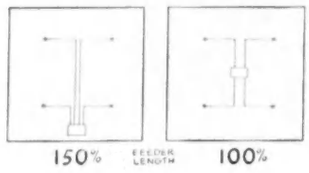
From all these facts, one conclusion stands out clearly. You men in the field—collectively—by making proper application of cable, transformers, motors, control, and other devices, can save even more copper than we can. You can save more in days than a manufacturer can save in months, just by making the right applications. We urge you to study the facts and lend your best judgment to the highly important job of conserving this most precious metal. *General Electric, Schenectady, N. Y.*

The Army-Navy "E", for Excellence in the manufacture of war equipment, now flies over six G-E plants employing 100,000 men and women.

GENERAL ELECTRIC

FOR NEW PLANTS OR PLANT EXTENSIONS, REMEMBER THESE SIMPLE COPPER-SAVING RULES





To carry 150 kva — 3 phase —

At 208 volts, requires this size copper conductor

At 240 volts, requires this size copper conductor

At 480 volts, requires this size copper conductor

A detailed explanation of these principles is available in our recent publication, "5 Ways to Conserve Copper." Ask for GED-1011.

1. Cover as much distance as possible with high-voltage circuits. Keep the low-voltage (heavy copper) circuits as short as possible.

2. Locate substations in the centers of load areas. Modern safety-enclosed unit substations make this practicable.

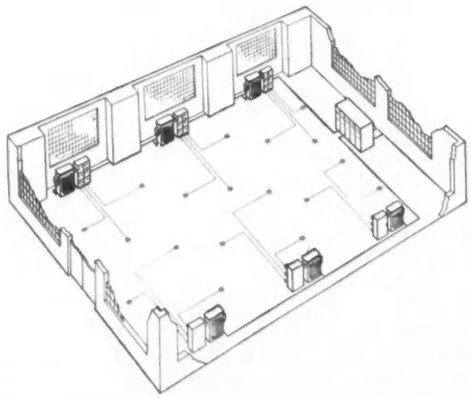
3. Use small-size substations. You save copper that way; but they must not be too small or your use of materials won't be economical. The optimum substation ratings for 480-volt secondaries are 750 and 1000 kva; and for 208/120-volt or 240-volt secondaries, 300 and 500 kva.

4. Distribute power at the highest practical voltage. For example, choose 440 volts for your integral-horsepower-motor circuits in place of 220 volts.

5. Use cable with high-temperature insulation to carry more current—varnished cambric instead of code rubber.

IF YOU SUBSCRIBE TO THESE PRINCIPLES YOU'LL WANT A COPY OF THIS BOOKLET...

GED-1006



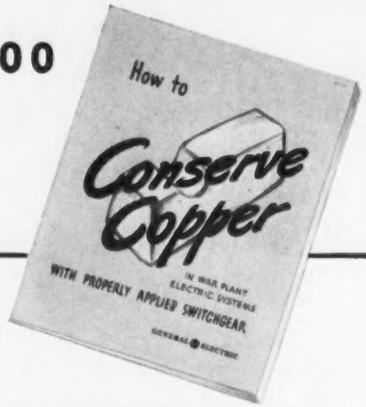
One of the important developments in electric power systems since the war began is the load-center method of distributing power in industrial plants. This is based on the use of compact, factory-assembled, load-center unit substations, as shown in the illustration at the left.

Power is distributed at relatively high voltage (2.4 to 13.2 kv) within the plant to load-center unit substations located near the centers of electrical load areas. There it is stepped down to utilization voltage (below 600 volts) and distributed to the load through drawout air circuit breakers and *short* secondary feeders. By keeping the heavy secondary feeders to the minimum length, considerably less copper is required, and the performance of motors, lamps, etc., is materially improved by the resultant reduction in voltage drop.

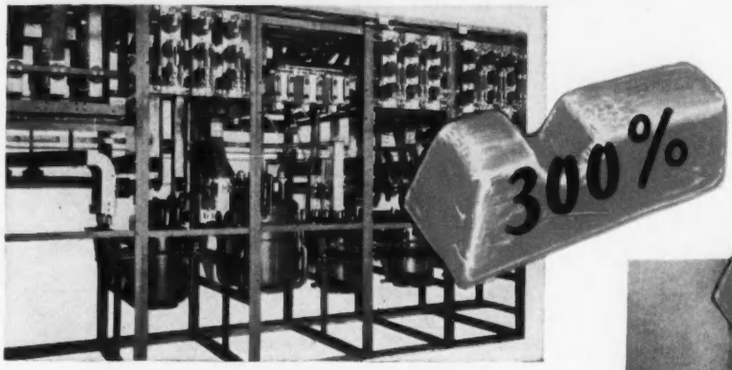
GENERAL ELECTRIC

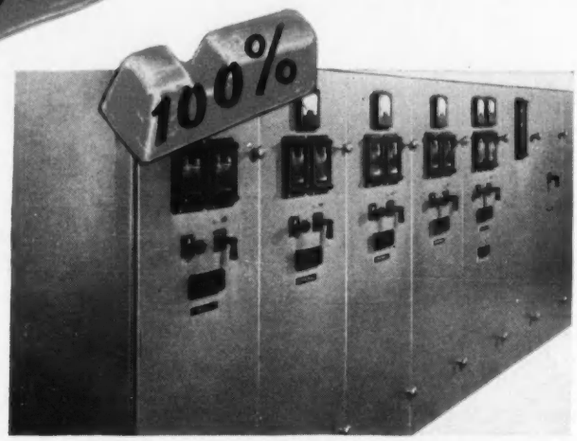
THE RIGHT KIND OF SWITCHGEAR, TOO MEANS COPPER SAVED

—AT LEAST 60%, ON MOST JOBS



Write for Bulletin GES-3031, on how to save copper through properly applied switchgear.



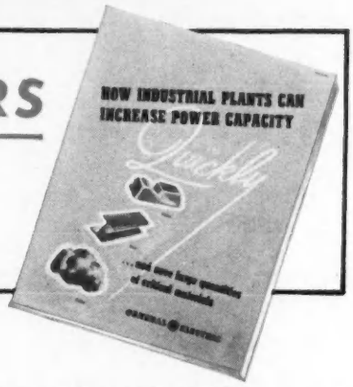


Open-type switchgear—with many strung-out copper interconnections mounted on a bulky, structural-steel framework—calls for a lavish use of copper.

Safety-enclosed switchgear is compact, and its copper interconnections are short. What's more, it completely eliminates the copper disconnecting switches seen in the open-type assembly (above), because modern vertical-lift breakers can be quickly and easily connected and disconnected from the main buses. These and other savings regularly cut switchgear copper requirements to less than *one third*.

CAPACITORS ARE GREAT COPPER SAVERS

They provide increased power capacity without adding new generators, transformers, or feeders.


HOW INDUSTRIAL PLANTS CAN INCREASE POWER CAPACITY
Quickly
...and save large quantities of critical materials
GENERAL ELECTRIC

1 INSTALLATION OF FOUR NEW CIRCUITS

	Critical Materials Required (pounds)			
	Copper	Steel	Others	Total
3 New 250-kva single-phase transformers	1525	8100	---	9625
4 New feeder circuit breakers	562	1800	512	2874
Cable for 4 new feeders	4940	---	1230	6170
	7027	9900	1742	18669

2 INSTALLATION OF CAPACITORS

	Critical Materials Required (pounds)			
	Copper	Steel	Others	Total
15 capacitors—90 kva each (One capacitor installed at each load center)	360	2370	2145	4875
SAVINGS IN CRITICAL MATERIALS	6667	7530	-403	13794

Consider a typical industrial plant 400 ft by 750 ft, which has a peak load of 3000 kva, served by 15 circuits, each carrying 200 kva. Because of a large amount of inductive equipment (motors, welders, etc.), the power factor of the circuit is only 75 per cent.

To meet demands for increased production, 718 kva of new power-system capacity must be supplied. You can install four new circuits of 200 kva each. Or you can install capacitors on each of the present circuits. The tables at the left compare the two methods. See how 13,794 pounds of critical materials (6667 lb copper) can be conserved. Incidentally, the capacitor method costs about half as much as the installation of new circuits.

How Industrial Plants Can Increase Power Capacity Quickly—and save large quantities of critical materials—is the subject of a new booklet (GES-3039) now available through your local G-E office.

GENERAL ELECTRIC

YOU MAY BE ABLE TO SAVE 25% IN *CRITICAL MATERIALS* BY MODIFYING YOUR PEACETIME MOTOR POLICY

The new G-E MOTOR FITNESS MANUAL tells what to do to get the most out of motors, old and new. If you are undertaking new work on motor-equipped machines, if you are "switching" motors from one job to another, or equipping machines with new motors, you'll find this bookful of helpful motor facts will save you valuable time. Included with it is another new publication—"How to Save Critical War Materials." This contains the latest WPB recommendations for the selection of motors, and other useful data. Write today for your "MOTOR FITNESS MANUAL, GED-1017."

MOTORS NEEDLESSLY LARGE FOR THE JOB—plus the oversize distribution circuits they require—may be 25 per cent or more on the side of the enemy! That's the percentage of copper and other scarce materials frequently wasted by overcautious motor specifications—by buying the "next larger size" than a machine actually needs.

The extra amount of critical material used in the oversize motor itself is only part of the loss. Operating a motor continuously below its rated capacity can mean wasted copper all the way back to the power plant. Therefore, even your present motors should be so applied as to avoid "overmotoring," wherever possible.

Why not check with your engineers to see if your peacetime motor policy can be modified in the cause of conservation? You'll be helping to make more metals available where they're needed most to win the war.

This new load calculator—the G-E MOTORULE—makes it easy to select motors that match the job when the recommendations of the machine builder are not available. It helps avoid the risk of undermotoring and the waste of overmotoring. With this motorule, you can check to make sure you are getting the most out of all your machine motors, old or new.

Accurate—easy to understand—applicable to the working of a wide range of materials. FREE with full instructions from your G-E Motor Representative or direct from General Electric, Schenectady, N. Y.

FIND METAL-CUTTING HORSEPOWER *QUICKLY* WITH THE G-E MOTORULE

NEW DEVELOPMENTS IN FLUORESCENT LIGHTING SAVE BOTH *COPPER AND STEEL*

The new G-E Forlamp (265-volt) ballast for war-plant fluorescent lighting operates four 100-watt lamps—twice as many as any ballast previously available. And it's the same size as the Tulamp 100-watt (118-volt) ballast.

This means a saving of 50 per cent in critical materials in plants where voltages within the 250–280 range are available. Furthermore, large savings of copper can be made in the lighting circuit, too, since this ballast operates on circuits of 277/480Y volts. Single-phase circuits of 277 volts require from 60 to 70 per cent less copper than those of 120 volts. Ask for publication GES-3033.

GENERAL ELECTRIC

HOW DESIGN . . . CONSTRUCT OPERATE MAINTAIN

Ash Sluice Pipe Life Quadrupled by Turning

By turning sections of piping at periodic intervals, so that abrasive wear is distributed around the inside circumference, engineers of the Michigan City plant of the Northern Indiana Public Service Company have been able to quadruple the life of some 760 ft. of extra heavy steel pipe in the plant ash sluicing system.

Ash in suspension in water settles out in the straight sections of the sluicing system and wears the steel pipe thin in a small segment on the bottom in from 18 months to two years. By turning the pipe 90 deg. every two years it is possible to obtain seven to eight years life from pipe which otherwise would have to be replaced at the end of two years.

A record is kept of the size and date of installation of various pipe sections as well as the date and number of turns, to guide scheduling of future inspection and turning.

It is interesting to note that pipe sections close to the pump are not worn as badly as straight sections and require less frequent turning. It appears that turbulence of the water in sections near the pump keeps the ash in suspension and reduces abrasion at bottom pipe segments.

Second-hand pipe or "seconds" have been used satisfactorily at this plant for ash sluicing pipe. Well casing, for example, that is slightly out-of-round is usable because the pipe is welded and not threaded and slight eccentricity of pipe sections is not a problem. Pipe of this type, costing from 6 to 8 cents per pound, when turned periodically to distribute wear is found to give economically satisfactory life compared with special abrasion-resisting pipe costing several times as much.

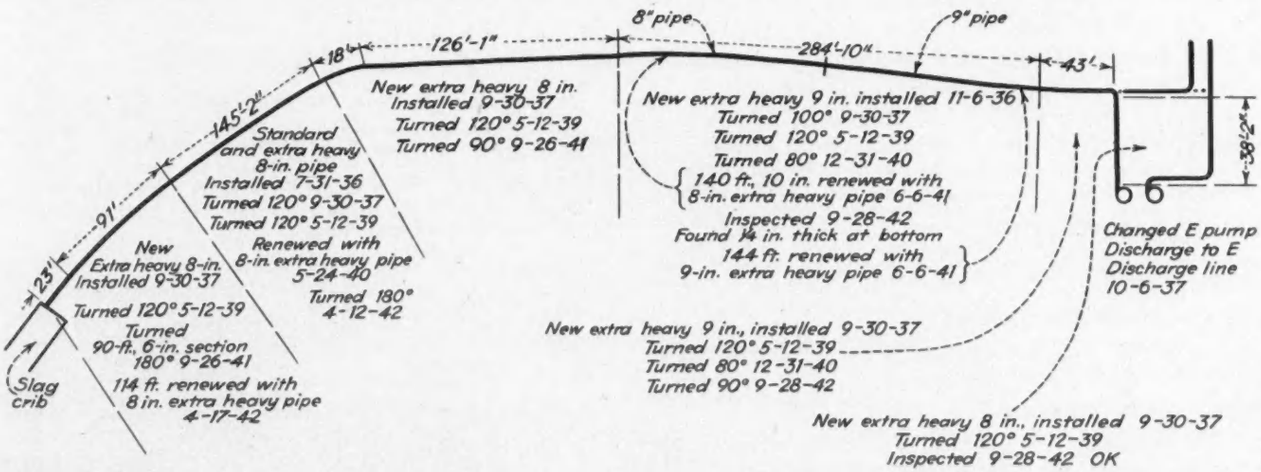
Completely Portable A.C.-D.C. Substation

By L. D. BANDEROB* and P. L. SALVAGE†

During the month of December, 1941, the Belridge Oil Company put into operation a direct-current electric drilling equipment of most modern design. Operating in the North Belridge Field during the past few months, the equipment has given an excellent account of itself, since it provides those qualities most desired by drillers, namely, ample power, flexibility, ease of control and portability.

The substation includes two motor-generator sets, each mounted on a self-supporting skid base. Each set is complete in itself and consists of a 350-hp. induction motor, driving a

* Belridge Oil Company.
† General Electric Company, Los Angeles, Calif.


8" pipe
9" pipe
18'
126'-1"
284'-10"
43'
145'-2"
91'
23'
New extra heavy 8 in. Installed 9-30-37 Turned 120° 5-12-39 Turned 90° 9-26-41
Standard and extra heavy 8-in. pipe Installed 7-31-36 Turned 120° 9-30-37 Turned 120° 5-12-39
New Extra heavy 8-in. Installed 9-30-37 Turned 120° 5-12-39 Turned 90-ft., 6-in. section 180° 9-26-41
Renewed with 8-in. extra heavy pipe 5-24-40 Turned 180° 4-12-42
Slag crib
114 ft. renewed with 8 in. extra heavy pipe 4-17-42
New extra heavy 9 in. installed 11-6-36 Turned 100° 9-30-37 Turned 120° 5-12-39 Turned 80° 12-31-40
140 ft., 10 in. renewed with 8-in. extra heavy pipe 6-6-41
Inspected 9-28-42 Found ¼ in. thick at bottom
144 ft. renewed with 9-in. extra heavy pipe 6-6-41
Changed E pump Discharge to E Discharge line 10-6-37
38½"
New extra heavy 9 in., installed 9-30-37 Turned 120° 5-12-39 Turned 80° 12-31-40 Turned 90° 9-28-42
New extra heavy 8 in., installed 9-30-37 Turned 120° 5-12-39 Inspected 9-28-42 OK

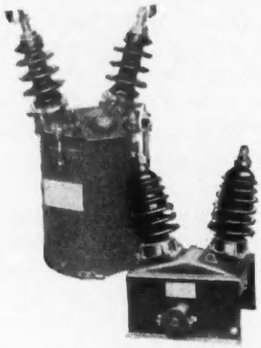
GRAPHIC RECORD shows date of installation, size, date and number of times ash sluice pipe has been turned to distribute wear. Pipe is given quarter turn every two years

Announcing

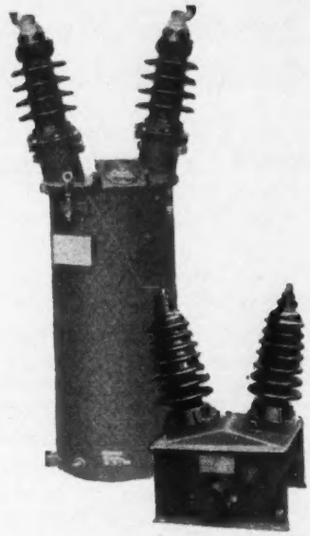
NEW OUTDOOR POTENTIAL TRANSFORMERS

THAT SAVE VITAL MATERIALS

NOTE THESE REDUCTIONS IN SIZE, WEIGHT, AND LIQUID VOLUME



24,000/120 Volts



34,500/115 Volts

	Type E-116	Type E-236
Height—inches	42	34¼
Width of Base—inches	15¼	18
Net Weight—pounds	350	320
Liquid Volume—gallons	9	5

Type E-116	Type E-236
71	36½
19	19
850	350
45	6

HERE ARE THE SAVINGS the Type E-236 transformers make possible for you—in addition to saving vital materials in manufacture.

SAVE SPACE

Their light weight and small size enable you to mount them in the steel structure and thereby save valuable ground space.

SIMPLIFY CONNECTIONS

Mounting in the structure simplifies primary (high-voltage) connections.

SAVE FOUNDATION EXPENSE

Mounting in the structure also eliminates the need for constructing a separate foundation.

REDUCE MAINTENANCE

The insulating liquid need not be tested or inspected, because it is hermetically sealed in—there are no gaskets on these transformers.

CHARACTERISTICS

All improvements have been accomplished without any sacrifice in accuracy or insulation—the two most important characteristics of any instrument transformer.

ACCURACY—These transformers meet the highest accuracy classification, ¼W, ¼X, ¼Y, ¼Z, and they are suitable for both metering and relaying.

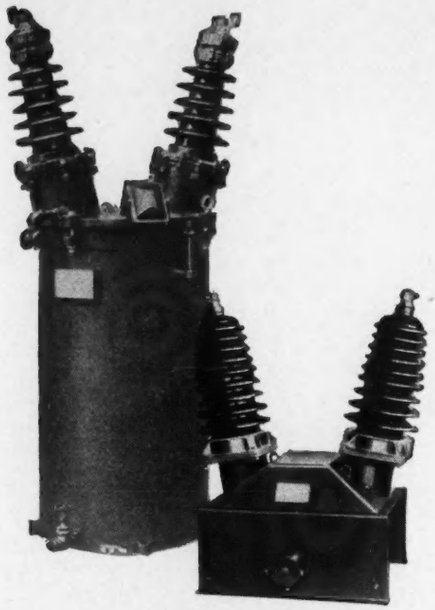
INSULATION—Ample insulation is provided to meet the ASA standards for impulse tests, as indicated by the following test data:

Transformer Voltage	Dielectric Tests	
	Full-wave, Kv	Low-frequency, Kv
24,000/120	150	51
34,500/115	200	70
46,000/115	250	93
69,000/115	350	140

GENERAL ELECTRIC

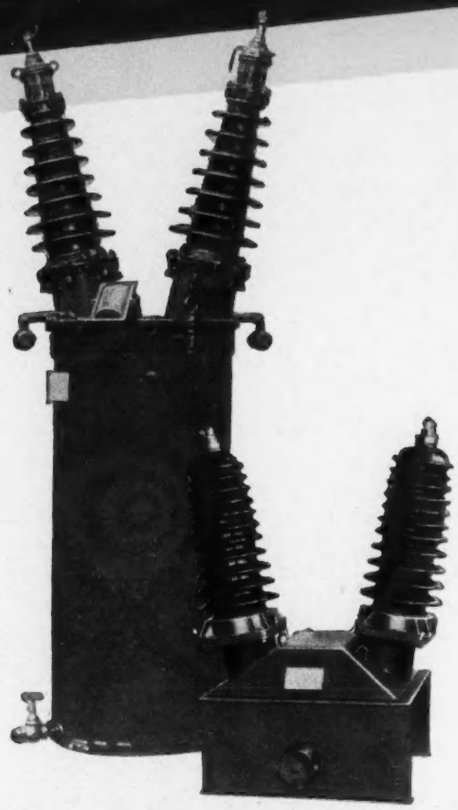
804-9-6409

TYPE E-236
TWO-BUSHING
PYRANOL OR OIL-FILLED
24 KV TO 69 KV
They Supersede the Type E-116



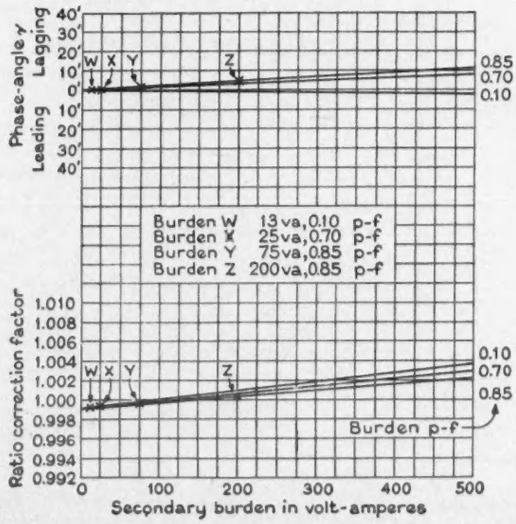
46,000/115 Volts

Type E-116	Type E-236
81¼	45
26¼	21½
1700	550
100	9



69,000/115 Volts

Type E-116	Type E-236
108	55½
26¼	28½
2400	1000
125	20



Ratio and phase-angle curves of the 69-kv unit—at 60 cycles, 115 secondary volts. (This is typical of the curves for all these transformers.)

The Army-Navy "E", for Excellence in the manufacture of war equipment, now flies over six G-E plants employing 100,000 men and women.

Completes Our Line of Small-size Outdoor Current and Potential Transformers

BECAUSE you can get G-E outdoor current and single-bushing potential transformers of corresponding small size and light weight, you can take full advantage of the small size of these new two-bushing units. You can now mount all your transformers up in the structure, and get the full benefit of foundation savings.

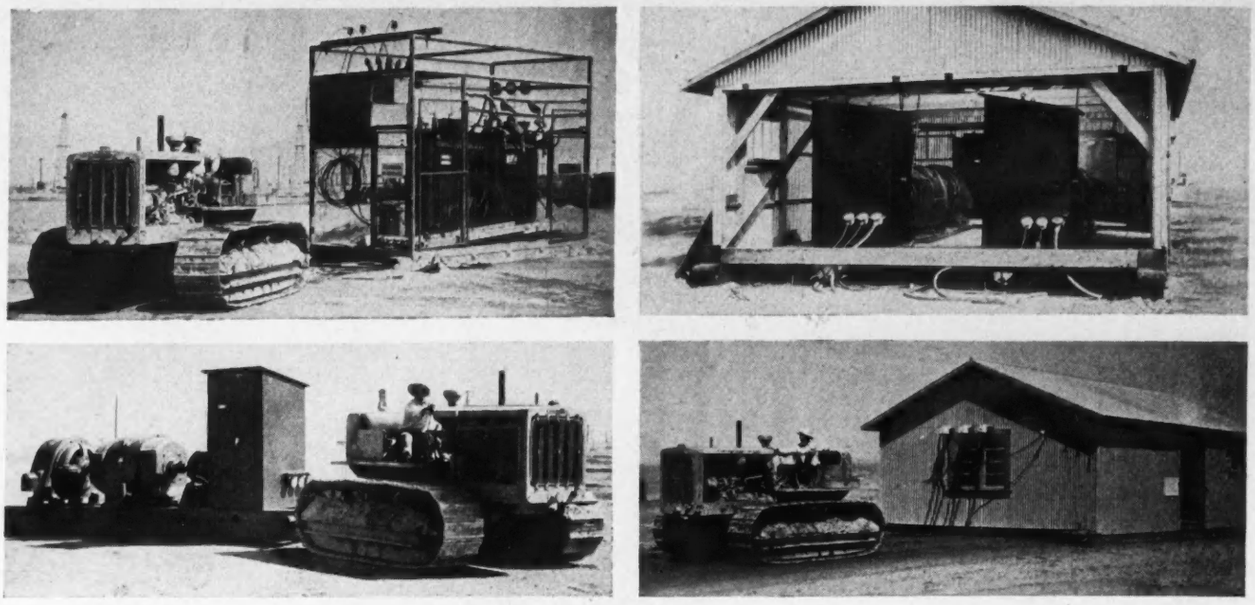
All these transformers are available filled with Pyranol* (or oil if you prefer). Because instrument transformers are such a vital link in the protection of your system, you'll want to insist on Pyranol—the G-E insulating and cooling liquid which is chemically stable. It means greater safety, too. It is noninflammable.

You can adopt G-E instrument transformers as standard for your system. General Electric makes a complete line of indoor currents and potentials, and portables as well.

For additional information about these new E-236 units, ask for Bulletin GEA-3982. Also, the specialist in the nearest G-E office will be glad to work with you in applying instrument transformers for either metering or relaying.

General Electric Company, Schenectady, N.Y.

**Reg. U.S. Pat. Off.*



COMPONENTS of substation on the march and partially assembled

200-kw. direct-current generator. Each set also includes a direct-connected exciter rated 15 kw. at 125 volts. Either exciter is capable of providing all excitation required.

With the exception of the driller's control, all control equipment is mounted in two cabinets—one of which is mounted on each of the motor-generator bases and remains a fixed part of this unit.

The building housing the motor-generator sets is a simple frame building, with a removable floor, made rigid enough to withstand moving from location to location on its own skids. (Switches and starters are left permanently installed.)

In practice, because drilling is confined to one field with relatively level terrain, it has been found most economical to simply tow the equipment from well to well with tractors. The house is first spotted and then the m-g sets pulled into place. The outdoor equipment, consisting of 600 kva. in power transformers, and the lighting transformers, is complete with its own fence, bus, oil switch, etc. This is likewise pulled into place with tractors.

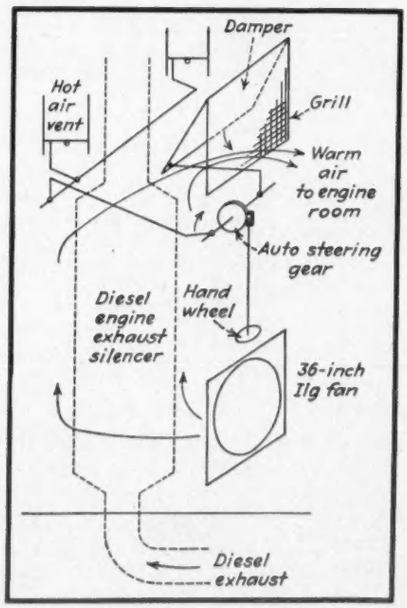
The electrical hook-up is simple. The large d.c. cables and control cables are laid in a plowed ditch. The control cables are provided with plugs and are connected to the couplers by plugging in. The various leads to the motors are identified by markings and can be connected readily.

When all motor connections are made the substation is connected to the 11,500-volt line and, as far as the electric equipment is concerned, drilling is ready to begin.

Generator Room Heated by Diesel Silencer

By W. E. VAN DEUSEN
Chief Engineer, Electric Department,
Rockville Center, N. Y.

Exhaust heat from the municipal plant's new 2,500-kw. Nordberg-Westinghouse diesel generator is discharged to the atmosphere in the summer but used to heat the engine room in the winter. The exhaust silencer is housed in a compartment adjacent to the engine room and there are two 24-in. vents to the outside. In summer the dampers are kept open and the 36-in. Ilg fan impels air from the room around the silencer to keep it cool. In the winter the heat picked up from the exhaust silencer is delivered into the engine room through a 36-in. square grille near the ceiling. Its damper and those of the two outdoor vents are manipulated by a single mechanism of linkages which is actuated by a hand wheel on a long vertical rod which turns an auto steering gear to close one set of dampers and open the other.



•

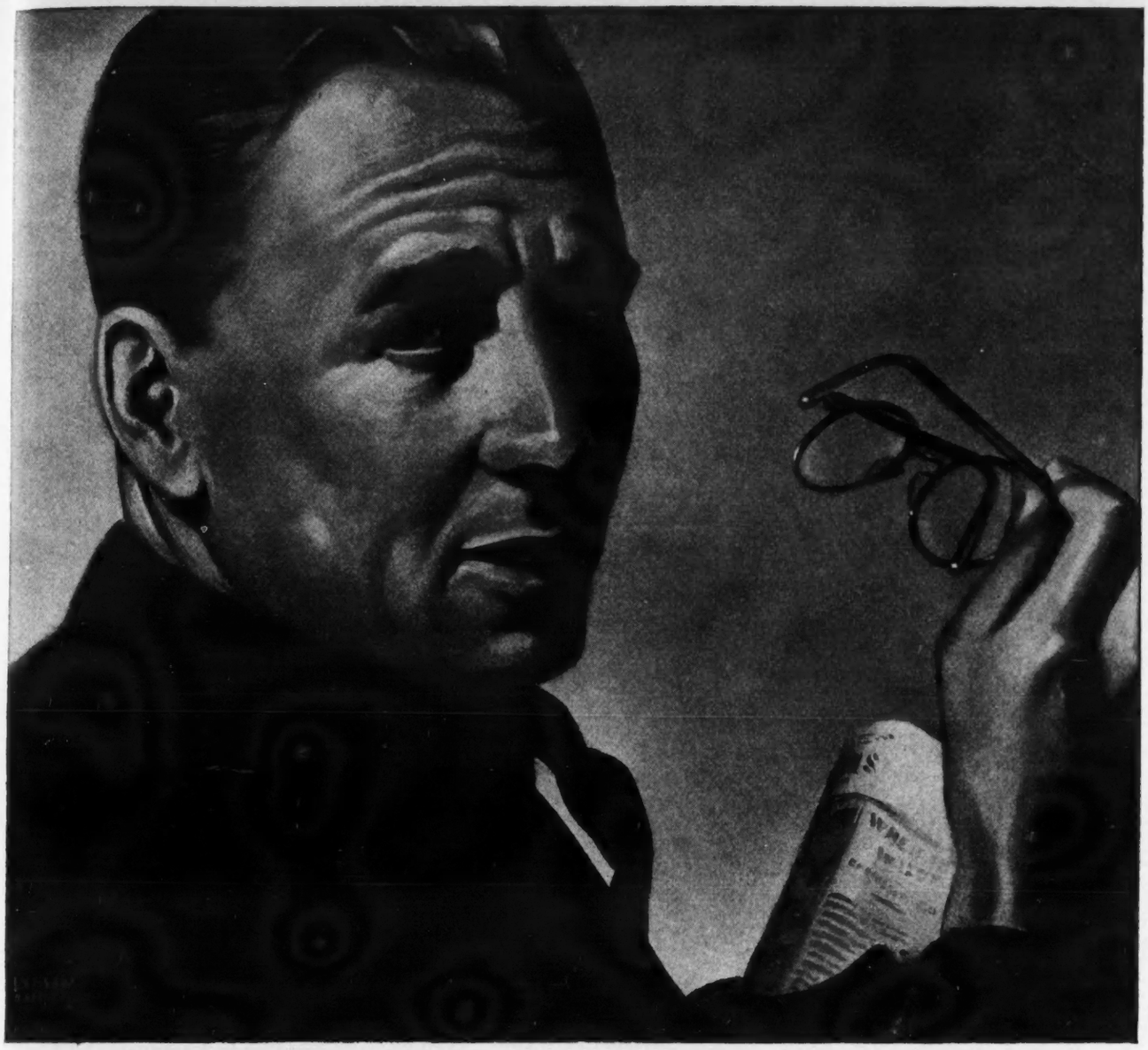
Temperature Rise of Conductors for Buses*

By WILLIAM DEANS
Chief Engineer
I-T-E Circuit Breaker Company, Philadelphia

So far as the conducting material itself is concerned, the limit of temperature rise would be that which causes impairment of the physical characteristics. Other considerations, however, dictate a temperature rise much lower than this.

When a busbar joint is first made

*This is the third in a series of seven articles on the general subject of bus design, which began in the December 26, 1942, issue of "Electrical World."



Now, Here's A REAL Dictator!

WHEN it comes to dictating, the great American consumer has them all beaten! As far as he's concerned, getting the best is very simple.

You just ask for it!

But supplying the best is not a simple matter for the manufacturers on whom this great dictator is casting his shadow—especially in the case of the new products he is expecting as soon as peace is declared.

Automobiles at half the cost, that go twice as far to the gallon! Houses that cost no more than a good car, but with all the conveniences of a palace! Household equipment that will be compact and indestructible! Air conditioning, radiant heating, television, electronic household controls...

And priced so that the average American can afford all of them!

American industrial ingenuity *will* give the consumer what he wants. But it will take revolutionary practices. And often the use of apparently fantastic materials.

Of course the war has brought about the eager testing of every material that research and metallurgy could devise. And many of these substitutes have earned a definite place in the field of metallurgy.

But which material? Under what circumstances? For which specific application?

Revere can help answer many of the questions that beset industry. For just as industry in the future will not be restricted to the traditional materials, neither will Revere. Since the war started, in addition to widening still further the uses for copper and its alloys, Revere has gained wide experience with the light metals, and has developed wholly new kinds of alloys with important properties that can cut manufacturing costs for many industries.

With this great expansion in the range of Revere metals, you can be sure of singularly impartial service from Revere. Today, the copper industry is working all-out for Uncle Sam. No copper is available except for winning the war. But post-war planners with specific problems in metals are referred directly to the Revere Executive Offices in New York.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

Executive Offices: 230 Park Ave., New York

it has a certain resistance and, therefore, a certain voltage drop, and as the atmosphere acts on it the joint becomes oxidized or otherwise is affected by the atmosphere. The resistance of the joint increases. This, in turn, accelerates the chemical action and so the resistance is further increased. Meanwhile, an increase in resistance increases the heat generated at that point, and therefore raises the temperature. An increase in temperature accelerates the whole process. The whole process is progressive. It follows, therefore, that, unless some precautions are taken, the resistance of the joint may continue to increase to a point where the local temperature becomes dangerous.

Temperature Limited

Most electrical apparatus is rated upon the basis of a limited temperature rise. A bus connected to that electrical apparatus must be so arranged that it does not run at such a temperature that heat will flow from the bus into the apparatus. This would be unfair to the apparatus, for heat flowing into it which it did not generate would result in a temperature in the apparatus higher possibly than would be safe for the apparatus. From all these considerations the temperature rise of a bus carrying full load is limited, according to agreement, to 30 deg. C.

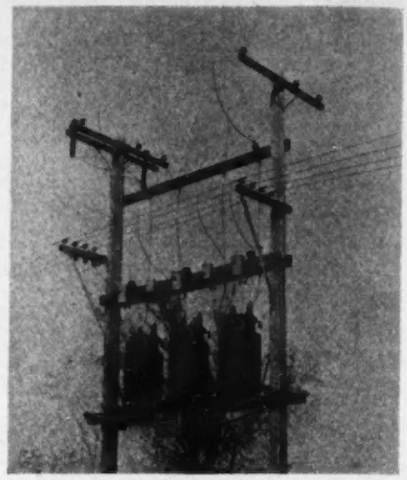
Considering the silver-plated joints for copper conductors in their effect limiting the temperature rise, it is found possible to raise the upper limit for the temperature. With silver, the compounds usually formed by the action of elements in the atmosphere are usually conducting. Compounds formed by the atmosphere on copper are usually non-conducting. Therefore, with the silverplated joint, it is to be expected that its resistance will remain more nearly constant over a period of time than will a plain copper joint. With the silver there is no progressive action of increase in resistance, etc. Two joints similarly made and of similar dimensions will have the same resistance at the start, one joint being of copper, the other of silver-plated surfaces. As time goes on, however, the resistance of plain copper joints will increase continuously, while that of the silver-plated joints will increase slightly and then become fairly constant.

The present A.I.E.E. rules allow a temperature rise of 30 deg. C. over the temperature inside an inclosure where the joints have received special treatment and further allow that the air temperature inside may be 15 deg. higher than the air temperature outside the inclosure. The characteristics of the plain copper joints made it necessary to allow the margin of safety, so as to permit the progressive increase in temperature due to deterioration, but in the case of the silver-plated joints and their equivalents, since this progressive action does not exist, it is possible to omit this margin of safety. The higher maximum allowable temperature is therefore safe, for heat will not flow from the bus into the connected apparatus. An aluminum joint, when properly prepared and executed, may be regarded practically as the equivalent of a silver-plated joint, although, strictly speaking, the aluminum joints have not been fully covered in A.I.E.E. rules.

•

Steel-Poor Transformer Platform

Shown is a truss-type transformer platform, built largely from timber and pole line hardware, that is used on the system of the Nebraska Power Company. The platform, which employs a minimum of structural steel

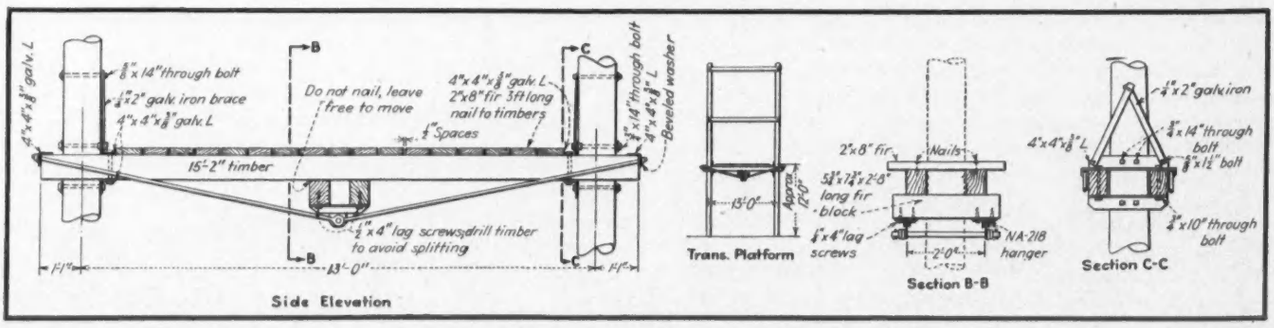


TYPICAL truss-type transformer platform supporting three 100-kva., 13,200-volt transformers

as an element of design, eliminates the unsightly supporting column commonly used under the center of such heavy-duty platforms.

To truss up the two main $5\frac{3}{4}$ x $7\frac{3}{4}$-in. beams of the platform 1-in. x 8-ft. anchor rods are used as shown in the design drawing. These rods are the tension members of the truss and are fastened to the center of the structure by passing a $1\frac{1}{2}$-in. x 2-ft. 8-in. iron pin through the eye of the anchor rods. This pin engages the holes of two transmission double-arm hangers lagged to fir blocks under the main timber beams. Other ends of the anchor rods are bolted to 4 x 4 x $\frac{3}{8}$-in. angles supported across the top outside ends of the timber beams of the platform. The timber beams are cut from standard transmission crossarms.

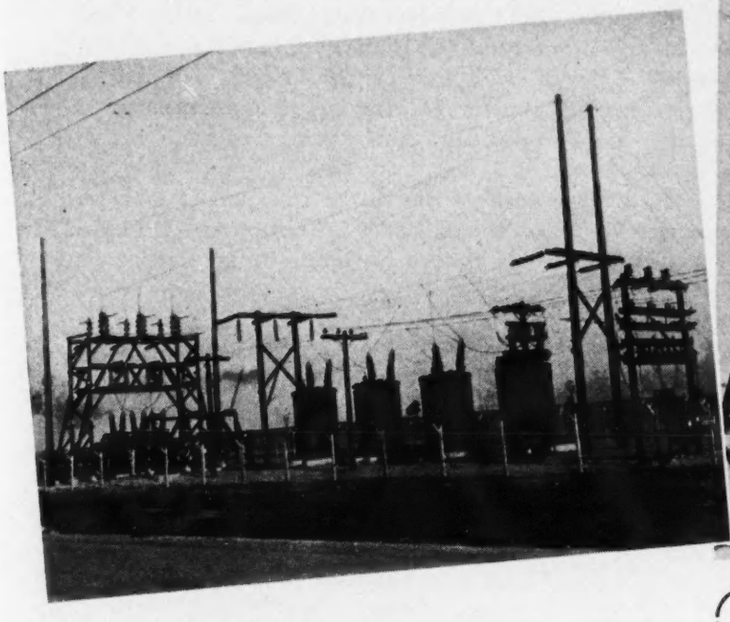
This type of platform is commonly used by the Nebraska Power Company for mounting three 75-kva. and occasionally three 100-kva. power transformers. A typical platform supporting a bank of three 100-kva. transformers is shown.

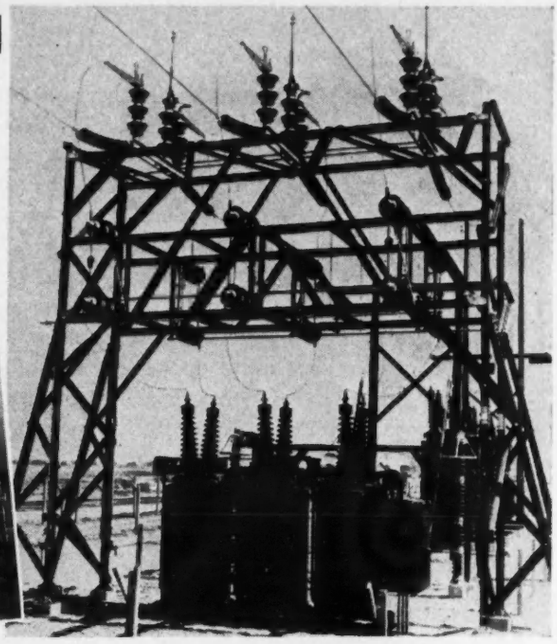


TRANSFORMER PLATFORM made from timber and pole line hardware conserves structural steel

WOOD STRUCTURES

CONSERVE 25,073 POUNDS OF STEEL IN THIS 110 KV. STATION





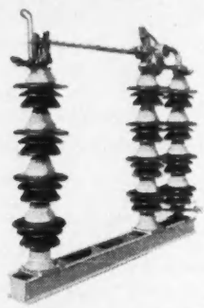
SINCE the War Production Board has ruled that steel is not to be used for power station structures (except in rare cases), wood rises to the forefront as the logical and practical substitute. In the station pictured here, for instance, steel structures doing the same job would have weighed over 25,000 pounds.

Always striving to anticipate trends and necessary changes of practice, Southern States Equipment Corporation was one of the first manufacturers of electrical equipment to offer station structures fabricated of wood. Several stations manufactured by Southern States and using wood structures are already in service on war projects. At the time of this printing, several more stations using wood structures are being manufactured for ordnance plants.

When you are planning to erect a substation or stations, regardless of size, send Southern States a print of your single-line wiring diagram. Southern States' engineering department will gladly furnish you with layout drawings of the station to do the job, together with our formal proposal. No obligation, of course. Address inquiries attention *Engineering Department, Station Division.*

INVESTIGATE SOUTHERN STATES' NEW TYPE CH HIGH PRESSURE SWITCH

Used on Subject Station



Advantages:

- *Type CH is three insulator, group operated, high pressure disconnecting switch.*
- Perfectly controlled continuity of blade motion in opening or closing.
- *300 pounds pressure at jaw contacts.*
- Special hinge in jaw contact assembly prevents bending stress from being transmitted to insulator stack.
- *Contacts are self-wiping, full-floating and self-aligning.*
- Compression springs are protected from sleet.
- *Operating arm exerts full ice-breaking leverages.*

Write for full information concerning Type CH high pressure group operated disconnecting switches.

Southern States SS Equipment Corp.

28 South 20th Street Birmingham, Alabama

There Is A Southern States' Representative Near You

How to Check A Meter Installation*

GENERAL INSTRUCTIONS

Every watt-hour meter should be checked for correct connections immediately after being installed. This is comparatively simple on most self-contained installations. The wiring can be checked at a glance to be sure that line and load wires, and the potential tap when one is required, are connected to the proper points. A ready check for a rough idea of the operation is obtained by noting the direction of rotation and approximate speed after the load is turned on. Anything overlooked in this check should readily be detected by the tester on the first installation or periodic test.

Installations requiring instrument transformers are not so easily checked and are also more liable to wrong connections. It is possible to get incorrect connections without making an error in the wiring; for instance, a wrong polarity on a transformer, a coil reversed inside the meter, the wrong ratio marked on a transformer, and numerous other such inconsistencies.

It is entirely out of the question to look for all these things, but it is recommended that a few rough checks be made to assure correct connections.

There have been published a large number of methods of checking installation, consequently the following is not intended to cover the subject in full, but a few simple checks will be outlined, some of which may suggest others equally as good.

THREE-WIRE NETWORK METERS

1. Cross-phase check—interchange top and bottom line potentials. Meter should run backward on reasonably balanced loads regardless of power factor.
2. Check one element at a time. Meter should run at same speed on each element at balanced and constant load on any power factor.

THREE-PHASE, THREE-WIRE METERS

1. Cross-phase check—interchange top and bottom line side potentials. Meter should stop on balanced load regardless of power factor.
2. Open common or No. 2 potential. Meter should run at half-speed on balanced and constant load.
3. Read current in each lead. On three-phase, three-wire installation using two current transformers, all leads should read the same on balanced load. This will give a check on connections and comparative ratio of transformers.
4. Relative speed and direction of elements when power factor is known.

THREE-PHASE, FOUR-WIRE DELTA (TWO ELEMENTS) METERS

1. Check one element at a time. Speed of meter should be the same for each element on balanced load regardless of power factor.
2. On unbalanced loads, when the approximate three-phase and single-phase loads are known, check each element at a time. The top element measures half of the three-phase load.

THREE-PHASE, FOUR-WIRE WYE (TWO ELEMENTS) METERS

1. Cross-phase check—interchange top and bottom line potentials. Meter should stop on balanced load regardless of power factor.
2. Open common potential. Meter should run at half-speed on balanced and constant load. The No. 2 current does not affect this check.
3. Check one element at a time. Meter should run at same speed for each element on balanced and constant load regardless of the power factor.
4. Relative speed and direction of elements when load and approximate power factor are known.
5. Read current in each lead. On balanced load the three line currents should be the same and the neutral current should be zero.

MISCELLANEOUS CHECKS

Single-phase wattmeters for finding relations between voltages and currents.

Comparison of power factor computed from runs of top and bottom elements of kw.-hr. and from kw.-hr. run against rkvah.

Voltmeter and ammeter checks—read all currents and voltages. This will check on connections and ratios of instrument transformers.

Of course, it is not intended that all of these checks be made, but it is advisable to make at least one and probably two independent checks, being careful to note any inconsistency.

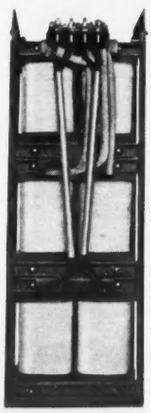
It is also advisable to indicate on the initial test sheet that certain checks were made and what the results were.

*From a book on meter standards observed by several Eastern utilities.

NOW! a complete new line of L-M THREE PHASE TRANSFORMERS

"They're the biggest transformer news since the birth of the Round-Wound!" declare engineers who have carefully pre-viewed the new L-M Three Phase Transformers.

Every unit in the complete line measures up to the L-M tradition of giving you more for your transformer dollar because every one of them is sound in the fundamentals ...of design, materials, workmanship. That is why, wherever the most efficient and economical operation of your distribution system calls for a three-phase transformer, it will pay you well to install an *L-M* Three Phase Transformer.



VERTICAL TYPE

L-M Three Phase Transformers save space, eliminate platform constructions, give you trim, neat, on-the-pole installations. You will find these L-M Vertical types in ratings up to 150 Kv-a, and up to 13,200 volts. *Ratings up to and including 75 Kv-a have L-M Round-Wound core and coil assemblies.*

CONVENTIONAL TYPE

L-M Three Phase Transformers in sizes 100 to 500 Kv-a are generously designed throughout, insure rugged, punishment-taking stamina. Round coils, free from right angle bends, assure greater mechanical and impulse strength, damage-free insulation and long service life.

GET FULL INFORMATION

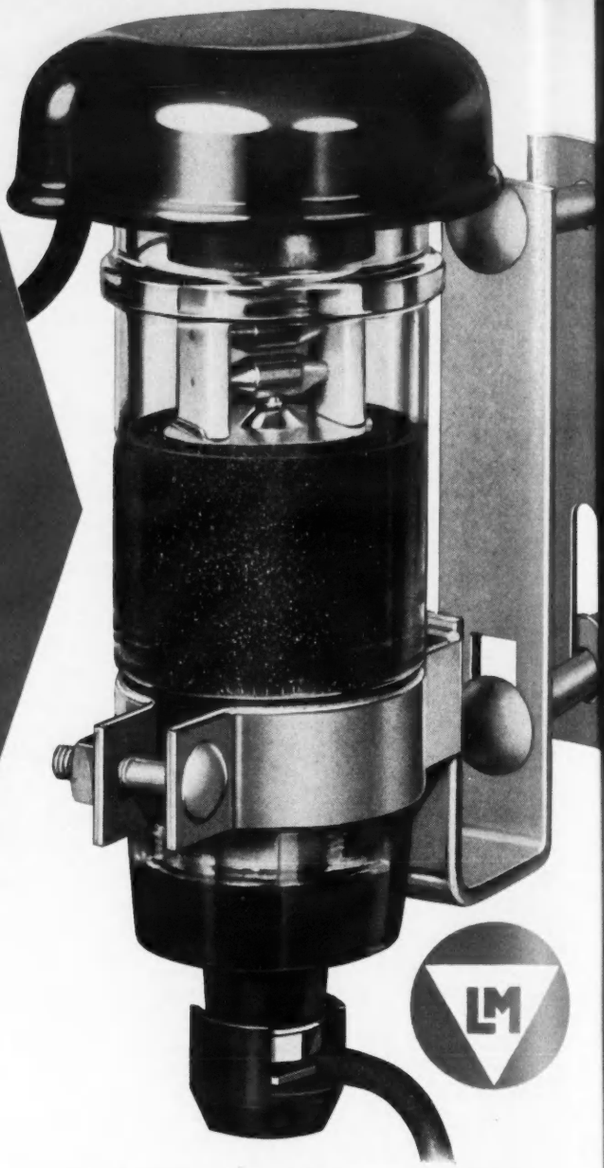
Before you invest in another three-phase transformer be sure to get the full, interesting story about the complete line of L-M Vertical Type and Conventional Type Three Phase Transformers. The new *L-M Three Phase Bulletin*, No. 43161 is ready. Ask your L-M representative, or write Line Material Co., 802 N. 8th St. Milwaukee, Wis., for a free copy.

LM

LINE MATERIAL COMPANY

particularly today - you need

L-M HEAVY-DUTY LIGHTNING ARRESTERS



for these 6 good reasons:

1 HIGH SURGE CAPACITY — The special L-M valve composition will handle high-amperage and long-tail surges equally well.

2 LOW IMPEDANCE — Due to its characteristics, the L-M valve material holds internal resistance (IZ drop) to low values at all surge currents.

3 MOISTURE-PROOFNESS—Double "elastic" sealing at top and bottom, controlled production and thorough routine tests result in highest, permanent moisture-proofness.

4 PERMANENCE OF CHARACTERISTICS —L-M valve material is chemically and electrically absolutely stable, does not change its characteristics in operation, assures same unfailing operation, after years of performance.

5 VISUAL-INSPECTION GLASS BODIES — Glass bodies, exclusive with L-M Arresters (Pat. No. 2,165,964) permit easy inspection of Arrester condition at any time without costly laboratory or field tests.

6 THE ISOLATOR FOR FEEDER-LOCK-OUT PREVENTION—Any arrester might become damaged at some time in service. The L-M ISOLATOR will then save you time and money because it will automatically cut off the faulty arrester from the line, preventing feeder lock-out or phase grounding—Only L-M Arresters have the ISOLATOR. (Pat. Pending).

Detailed information further explaining and illustrating these features and the reasons why they contribute to better service are fully covered in L-M Bulletin 40151. Write for it or ask your L-M representative for a copy.

You get them all only in

L-M HEAVY-DUTY LIGHTNING ARRESTERS

LINE MATERIAL CO.

Switching Scheme for Off-Peak Meters

Flexibility and low cost favor the system of meter switching devised by the Indiana Service Corporation to measure on- and off-peak kw.-hr. and rkva.-hr. supplied to a large arc-furnace installation in Fort Wayne. The arrangement shown makes use of separate on- and off-peak kw.-hr. and rkva.-hr. meters and three standard time switches for weekdays, Saturday and Sunday-peak-hour schedules. The time switches actuate a relay to transfer potential from off to on-peak meters and reverse.

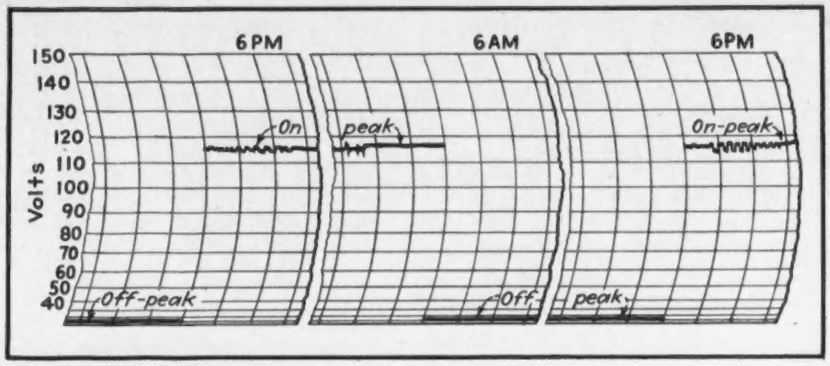
Originally the arc furnace installation, which is served by a 7,500-kva. bank of transformers, was supplied on an off-peak rate and operated during night hours only. Metering was, and still is, done on the 33-kv., three-phase, three-wire delta side of the transformer. Recently an increase in demand for the product led the customer to request on-peak service.

A new rate was applied, therefore, which called for measurement of kw.-hr. and reactive kva.-hr. for on-peak billing at one rate and for the off-peak billing at a different rate. On-peak hours are from 7 a.m. to 9 p.m. on weekdays, from 7 a.m. to 1 p.m. on Saturdays and for Sunday all service is off-peak. Any metering scheme to meet this schedule had to be flexible, to be changed readily.

Original problem, as visualized, was to install two sets of kw.-hr. and rkva.-hr. meters or one set having double registers on the present 33-kv. instrument transformers and control these registers for measurement of on-peak kw.-hr. and rkva.-hr. on one set of registers and all off-peak on the second set.

It was desirable to use control equipment that would transfer registration from one pair of registers to the other with an accuracy of within five minutes of clock time. It was also desirable to provide visual indication of which set of registers was in operation as well as some kind of continuous chart record of the hours each register is in service.

The manner in which these requirements were satisfied is shown in the accompanying diagrammatic sketch. The three time switches were set for weekday, Saturday and Sunday schedules and used to actuate a single relay that transfers potential from the off-peak to the on-peak meters. Relay contacts are in parallel with the time switches and the circuit arranged to apply potential to the low-rate meters when the relay is energized. Signal lamps indicate which set of registers is in operation, while a recording voltmeter provides a record of hour on, and off-peak. The chart gives a potential indication (magnitude is not significant) when "on-peak" registers are in operation, a zero indication when on off-peak.



SAMPLE SECTION of chart shows accuracy of switching

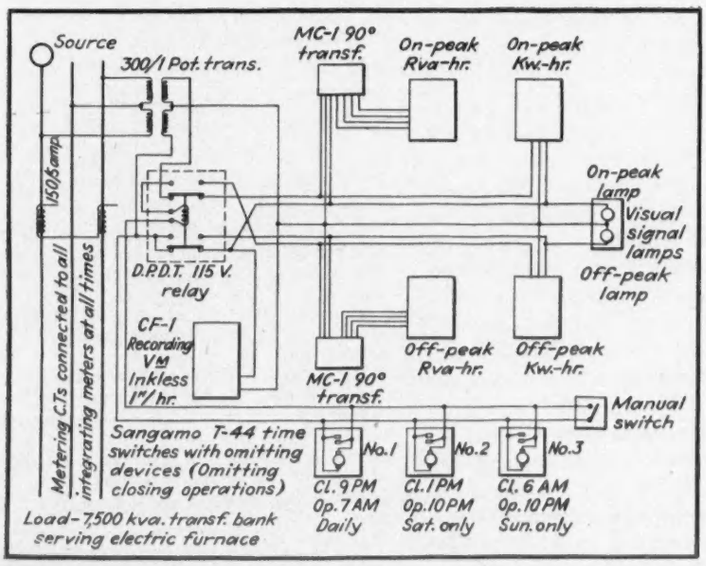
•

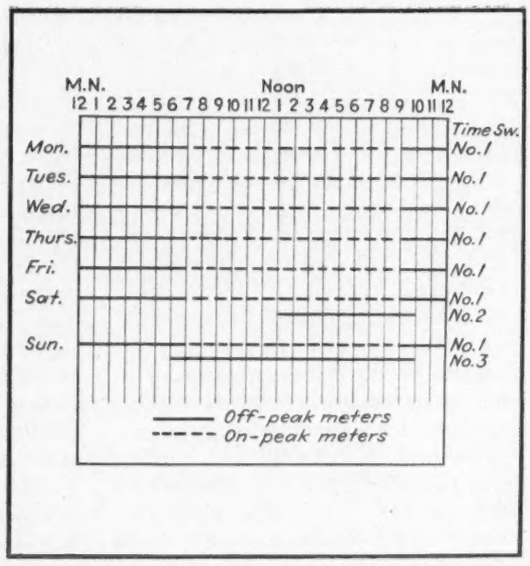
Current Doubled for Niagara Transformers

By F. H. WOODS
Maintenance Foreman
Cincinnati Gas & Electric Company

While increasing capacity of transmission circuits, it became necessary to increase capacity of 66,000-volt, 300- to 5-amp. air-insulated current transformers to 600 amp. capacity.

The primary winding originally consisted of 6½ turns of 375,000-cir.mil. rubber-covered stranded cable wound in a circle of 30-in. internal diameter. Six turns of primary winding were in field of secondary wind-





TIME-SWITCH relay scheme controls kw.-hr., rkva.-hr. meters on off-peak schedule (left). Schedule of time switch operations (right)

ing. The secondary winding consisted of approximately 360 turns of No. 10 weatherproof wire wound on a square laminated iron core of 3x3-in. square section and 35x35-in. over-all dimension. Approximately 25 turns of No. 18 resistance wire were wound over secondary and shorted. This is for phase-angle control. Original primary winding was wound overhand so that only six turns of the $6\frac{1}{2}$ turns were encircled by the iron core. When rewinding for 600 amp., in order to use the same wire, we wound in the opposite direction two in hand in such a way that three turns were encircled by the iron core. Before calibrating we reversed the polarity marks on the secondary.

A form was made for winding the primary in place. After completion of winding, the transformers were checked for ratio, phase angle and polarity. This usually required the removal of a few secondary turns and addition of a few turns of resistance wire to shorted turns for correction of phase angle.

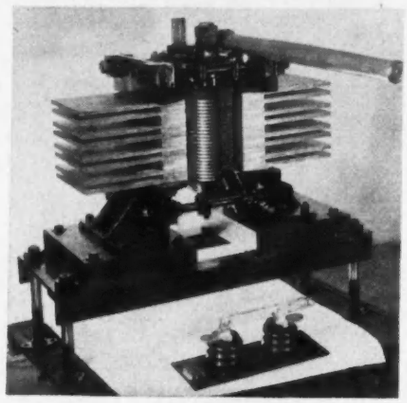
While the transformers were in the shop secondary windings were dried out in the oven and both windings were coated with two coats of liquid asphalt paint and one coat of plastic asphalt for waterproofing. Rebuilding of 45 transformers averaged 37 man-hours per transformer and less than $10 for material.

•

30,000-Amp. Switch Has Novel Design

Shown in the accompanying illustration is a low-potential, heavy-current, short-circuiting switch designed not only to carry a current of 30,000 amp. without undue temperature rise but also to close and open this current with no more than 10 volts potential difference across the contacts in the open position. Development of the switch by Electrical Engineers Equipment Company, Chicago, was the outgrowth of rapid expansion of war industry and the use of new manufacturing processes requiring interruption of heavy current concentrations at low potential.

Because of the wear and burning that takes place when opening heavy-duty switches of this type, it was necessary in this design to accept a reasonable amount of contact deterioration but prevent such wear from unduly limiting the useful life of the switch. This was accomplished by arranging the stationary and moving switch contact elements so that with age they automatically advance and seat themselves on new points to assure clean contact surfaces. To achieve this a cam-shaped moving element was adopted which on closing wedges



SHORT-CIRCUITING SWITCH for interrupting 30,000 amp. at maximum potential of 10 volts uses cam-shaped moving element; contacts automatically compensate for wear and burning

against the solid plane surface of the stationary contact, providing a line contact of extremely high pressure. The eccentric contour of the moving contact face present a new surface to the stationary contact as the surfaces wear progressively under the influence of repeated operation.

Since these switches were to be manually operated it was natural that too much energy could not be wasted in lifting heavy switch blades against heavy contact pressure. Therefore, the double cam-shaped moving element is pivoted about a vertical axis, allowing manual effort to be applied to wedging the contact surfaces together.

To keep heat losses at a minimum, in addition to providing sufficient contact area, it was fundamental to keep current flowing in the shortest possible straight line. Therefore, a butted joint type of contact under extremely high pressure was necessary. Furthermore, it was necessary to insure that each unit "layer" of the cam-shaped moving element as well as each bar of the stationary contact surface carry its share of the total current in the switch. Careful alignment of the moving and stationary contact surfaces assures this, it is stated.

Since the butted joint contact pressures are of considerable magnitude for 30,000-amp. switches and over, the strain cannot be easily applied to porcelain insulators, or insulated switch bases in general. The switch shown, therefore, was designed so that the strain or load of the contact pressure is entirely taken up by insulated tie rods from switch clip to switch clip; to be absolutely neutralized as well as self-contained.

•

Transformer Fusing*

4. Emergency Substitutes for Fuse Elements

By H. L. LOWE
Ebasco Services, Inc., New York

In case fuse elements must be produced locally and flexible tails are not available, improvised tails may be made by braiding strands of annealed copper wire of No. 20 gauge, or smaller, if possible. A sufficient number of strands should be braided to give the same carrying capacity as the tails originally supplied by the maker. This is an important factor in establishing the operating characteristics of the fuse. If suitable wire for making tails is not available, a larger size, taken from the scrap pile, may be annealed and drawn down through suitable improvised dies.

Employment of various kinds of wire for fusible elements may be investigated as possible substitutes for manufactured links. A few experiments employing samples of various wires in suitable fuse holders, preferably of the type used locally, might be useful data for future guidance in the event that manufactured fuse links cannot be obtained.

Data given in the following references may be helpful if and when it becomes necessary for local manufacture of fuse elements:

Fusing Currents for Wires—Handbook of Chemistry and Physics, 22d edition; also Underground Systems Reference Book, page 300.

Fusible Metals and Alloys—Standard Handbook for Electrical Engineers, 7th edition, page 310.

Formulas for Fusing Currents of Different Kinds of Metal Wires—Standard Handbook for Electrical Engineers, 7th edition, page 310.

Fusing Effects of Current — Standard Handbook for Electrical Engineers, 7th edition, page 311.

*This is the fourth of a series of articles which began in December 12, 1942, issue of "Electrical World."

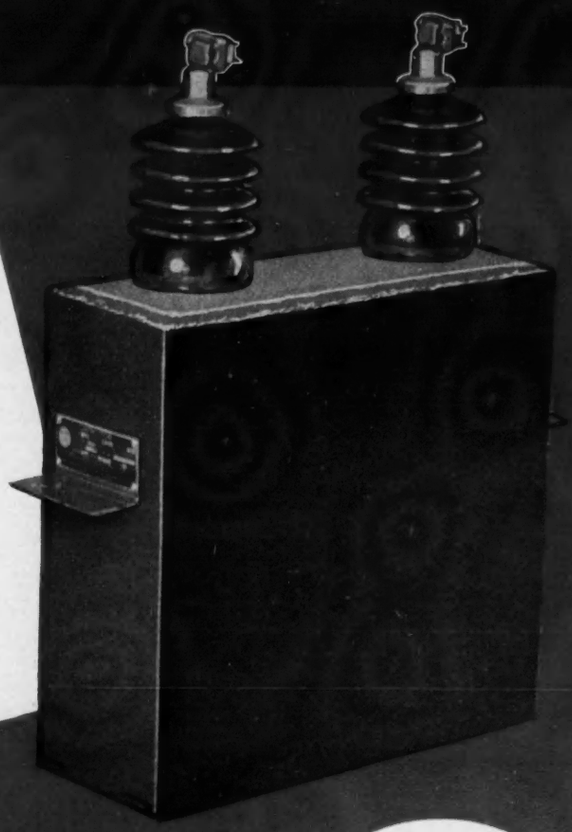
WHEN YOUR LOAD EXPANDS FASTER THAN ANTICIPATED

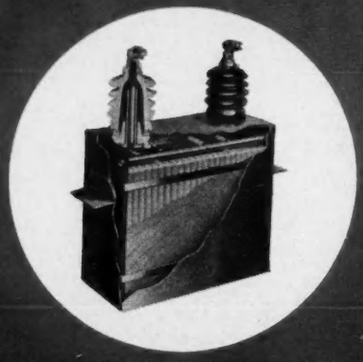
Get the most out of your present system by installing

C-D POWER-FACTOR IMPROVEMENT

CAPACITORS

Many systems have solved this problem of new — unexpected load—have quickly increased their load capacity 40% or better, without adding new feeders or sub-station equipment — by installing C-D Dykanol Capacitors. You too can enjoy these advantages — a C-D Field Engineer will be glad to estimate the increased carrying capacity of your system through power-factor correction. No obligation of course. Cornell Dubilier Electric Corporation, South Plainfield, New Jersey. New England Division: New Bedford, Mass.





CHECK THESE C-D FEATURES:

- C-D Dykanol Capacitors are engineered and manufactured by specialists who have made "capacitors" their exclusive business for over thirty-two years.
- C-D Dykanol Capacitors are available at short notice — and make minimum use of critical materials and valuable man hours.
- C-D Dykanol Capacitors can be grouped on poles at focal point of effective power-factor improvement.
- C-D Dykanol Capacitors can be installed without changing system layout.

C-D Dykanol Capacitors are filled and impregnated with non-inflammable, non-explosive chlorinated diphenyl, noted for its stable, high dielectric characteristics.

For further details on C-D Dykanol Capacitors write for Catalog No. 143C.

There are more Cornell-Dubilier Capacitors in use today than any other make

Cornell Dubilier

CORNELL-DUBILIER CAPACITORS

Reg. U.S. Pat. Off.

capacitors for power-factor improvement

**including all applications*

A GUIDE TO

SELECTION OF CONNECTIONS FOR DISTRIBUTION TRANSFORMERS

By F. M. STARR
Central Station Engineering Department, General Electric Company, Schenectady, N. Y.

To supply combined light and power loads in domestic, commercial and rural areas various transformer connections can be used. Where and which connection to use involves consideration of numerous factors. The accompanying table lists ten principal transformer connections and twelve characteristics. Connections which are dominant for a given characteristic are indicated by an asterisk (*). Transformers are considered to be in banks of three single-phase units connected to a three-phase distribution system.

In general, certain types of transformer connections stand out as being preferable. Two predominant types are the wye-delta (P.N.I.) and the delta-wye connections, which have many desirable characteristics. Of the two, the wye-delta (P.N.I.) arrangement appears to be superior to the extent that it is more flexible and costs substantially less. The delta-wye connection would be used only where 120/208-Y-volt, four-wire secondary service is required or desirable.

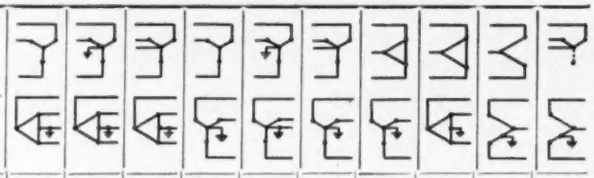
If the wye-delta connection is used the neutral should be isolated. The ungrounded connection may result in an occasional motor burnout, but it is not considered as serious as the increased liability of telephone interference and transformer burnouts which accrue with the grounded connection. Moreover, the problem of motor burnouts can always be solved by using three instead of the conventional two protective devices with the motor.

The wye-wye connection (P.N.L.) is widely used with three-phase, four-wire primary circuits, and with the exception of harmonic currents which it introduces into the line is generally free from objections and troubles. Where flexibility is important and a 120/208-Y secondary voltage is permissible the wye-wye (P.N.L.) is recommended.

The wye-wye (P.N.I.) has so many undesirable characteristics that it should never be used.

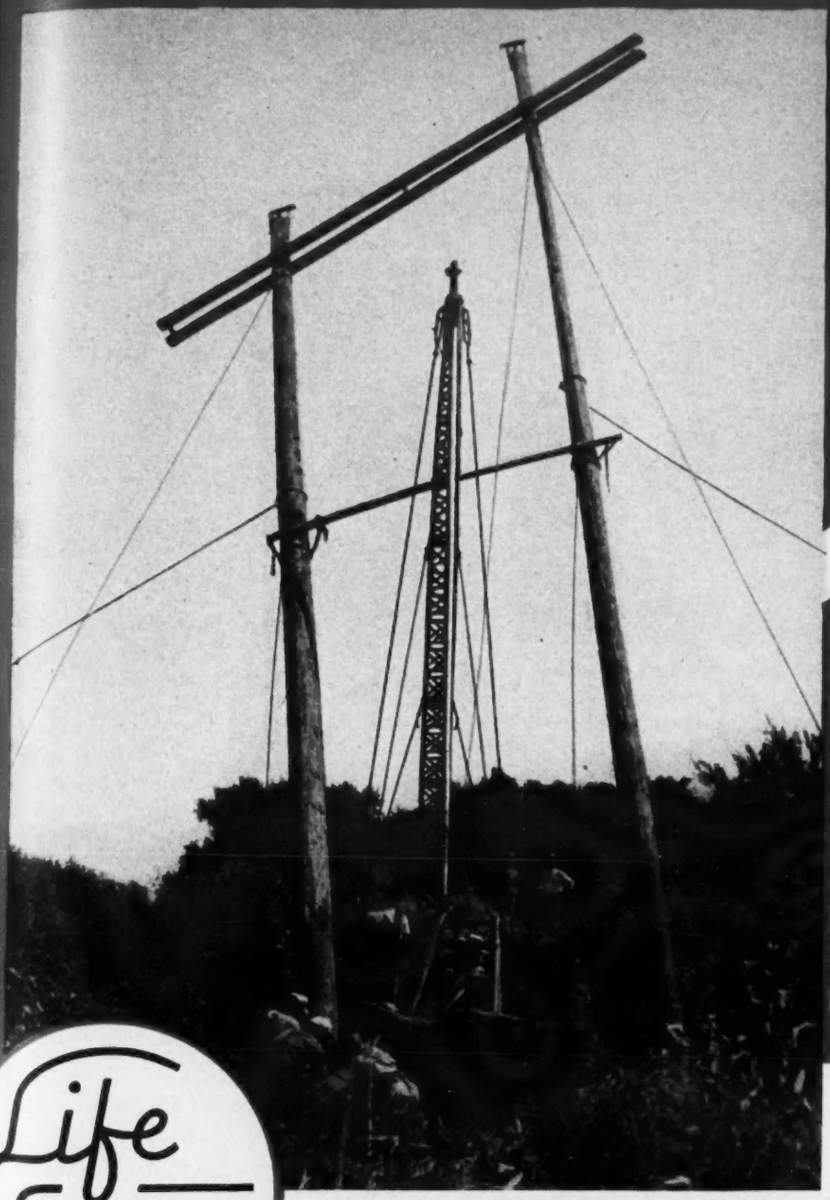
The open-delta connection is recommended to serve a very large single-phase load in conjunction with a small three-phase load. Normally, however, dissymmetrical connections have many objectionable features and are not recommended.

TRANSFORMER CONNECTION CHARACTERISTICS

Primary Connection / Secondary Connection										
Connection Reference†	A	B	C	D	E	F	G	H	I	J
1. Suitable for 120/208-volt wye distribution (usually urban)				*	*	*	*			
2. Suitable for 115/230-volt distribution (rural and some urban)	*	*	*					*	*	*
3. Relatively high in cost							*	*		
4. Flexible in application	*	*	*	*	*	*				
5. Susceptible to transformer burnouts with primary ground faults		*	*							
6. Susceptible to motor burnouts with primary ground faults										
7. Susceptible to substantial voltage distortion with unbalanced loads				*	*					
8. Best suited to slightly unbalanced loads	*		*							
9. Most suitable for large single-phase and small 3-phase load									*	*
10. Least vulnerable to third-harmonic troubles	*	*	*				*	*		
11. Least vulnerable to telephone interference troubles	*			*			*	*		
12. Percentage utilization of transformer capacity with balanced loads	100	100	100	100	100	100	100	100	86	86

NOTE—Probably the most common of the above connections for rural distribution is the wye-delta with primary neutral isolated. This connection and the wye-wye with primary neutral tied in with line neutral are widely used in urban practice.

†Connection reference: A—Wye-delta, primary neutral isolated (P.N.I.). B—Wye-delta, primary neutral grounded (P.N.G.). C—Wye-delta, primary neutral tied in with line neutral (P.N.L.). D—Wye-wye (P.N.I.). E—Wye-wye, (P.N.G.). F—Wye-wye, (P.N.L.). G—Delta-wye. H—Delta-delta. I—Open delta. J—Open-wye delta.



SAFE INSECTS DECAY!

Constructed for Iowa Electric Light and Power Company, Cedar Rapids, Iowa by Dowzer Construction Company, Hutchinson, Kansas.

Life Span

BUILD FOR THE FUTURE

With LIFE SPAN *Tox-i-tized* POLES!

Sold only by the following:

NAUGLE POLE AND TIE CORP.,
Minneapolis, Minnesota

PAGE & HILL CO., Minneapolis, Minn.
50 Church St., New York, N. Y.

SCHAEFFER-HITCHCOCK COMPANY
Sandpoint, Idaho—Supplier for Joslyn

LEAVITT-NAUGLE CO., Spokane, Washington
205 West Wacker Drive, Chicago, Ill.

● Today, in the construction of urgently needed new lines, time is counted in hours,—Tomorrow, in the continued delivery of trouble-free service, it must be counted in years! Choose the poles that have been treated for extra years of usefulness and life. Choose Life Span full-length tox-i-tized Cedar Poles. Through the use of a special highly toxic chlorinated phenol, the sapwood layer of Life Span poles has been protected against attack from insects or decay. With an added span beyond the normal, long life-expectancy of cedar, Life Span Cedar Poles are worthy of the job of carrying today's critical load.

CONSOLIDATED TREATING CO.,
Minneapolis ★ **Minnesota**

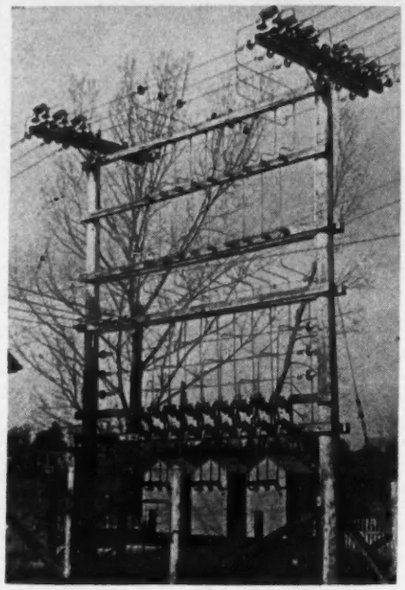
LIFE SPAN Full Length Treated CEDAR POLES

Indoor Breakers Used for Outdoor Station

By LOUIS W. MOORE
Operating Superintendent
Southern Canada Power Company,
Drummondville, Que.

Faced with the necessity of obtaining three current transformer trip oil circuit breakers for a new outdoor 4-kv. distribution substation, one utility solved its problem by revamping three (1914 vintage) Westinghouse type "B" oil circuit breakers, style S.O. 115360, which were rated at 300 amp., 11,000 volts. These breakers were indoor type and were arranged for switchboard panel mounting. Each breaker was originally equipped with a faceplate carrying two 5-amp. trip coils.

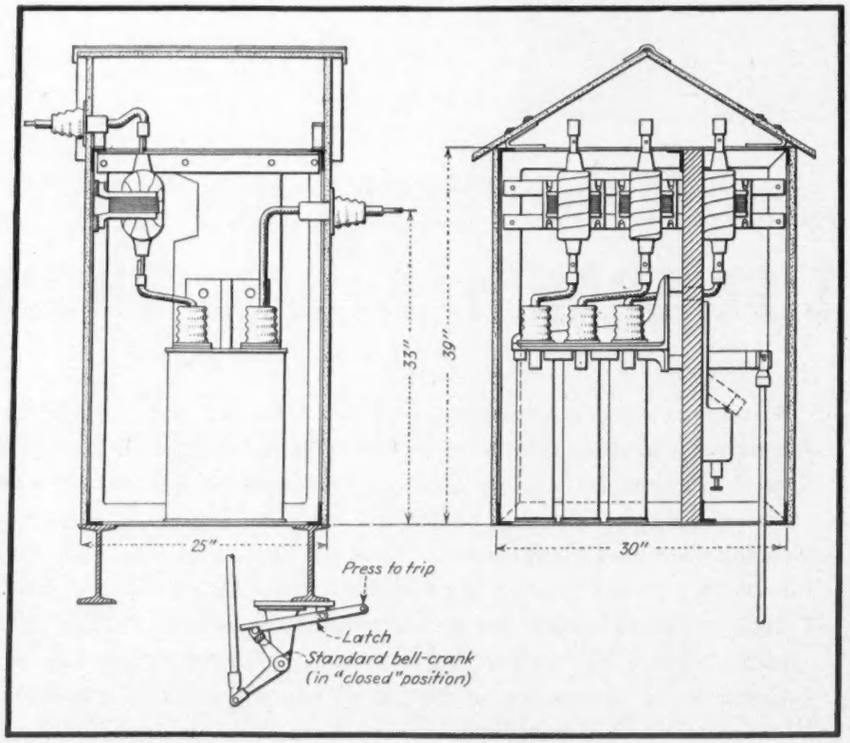
A shelter was designed to house each switch; the circuit breaker was mounted on a 2-in. panel securely bolted to the angle iron framework; mounting was provided to carry the three 250/5-amp. current transformers in each house. The 4-kv. wiring was done with scrap pieces of No. 2/0 extra-flexible rubber-covered stranded wire well taped with varnished cambric and cotton tape. Discarded pillar-type metering tank bushings were used as entrance bushings on both the line and load sides of the houses. Terminal boards were arranged on the panels, to which the six leads from the current transformers and the four leads from the trip coils were brought. A delta connection was used on the current transformers and all secondary wiring was done in color-code wire.



OUTDOOR 4-kv. distribution substation uses three indoor breakers with "dog-house" shelter for each mounted in a row on two 8-in. I-beams

As it was necessary to operate these breakers manually from a level below the bottoms of the shelters, a special operating handle and operating mechanism were designed. Each breaker trips automatically on a fault, but must be reclosed manually. Operation indicator disks were arranged to work mechanically with the tripping leverage to indicate as to whether the breaker was in the open or closed position. These disks work behind a circular glass window set into the transite.

When the breaker is closed the red disk shows. When open, green disk shows.



ANGLE-IRON FRAME; ½-in. transite for wall and peaked roof with galvanized iron flashing at joints; side walls demountable by removal of capscrews

Emergency Cable Has 17 Splices

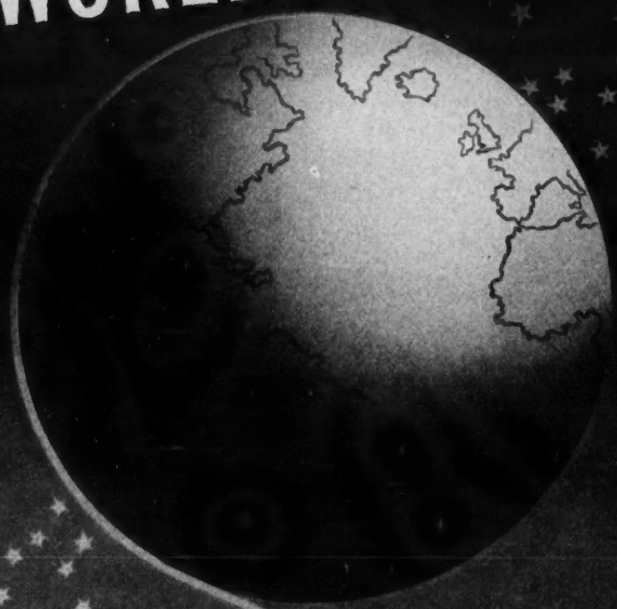
When an opportunity to conserve fuel in southern California steam plants developed through the temporary rearrangement of Boulder Dam generators Southern California Edison Company engineers were presented with the problem of securing three 200-ft. lengths of 1,250,000-cir.-mil, 13.6-kv. cable for low-tension generator leads.

The cable was assembled from scrap lengths found on the system by making 17 silfos splices.

The situation came about when the transformer installation for Edison's A-5 82,500-kw. generator was completed three months before the generator was ready for operation. Metropolitan Water District, one of the contractors for Boulder power, had a similar unit which was not being used. This machine was on the Nevada side of the power house. However, the Los Angeles Bureau of Power and Light, operating machines on both sides of the plant, had units A-1 and A-2 on the Edison side. An agreement was made whereby Edison temporarily took over unit A-2 and the bureau took over the MWD machine. The problem then was temporarily to connect unit A-2 to the A-5 transformer bank.

Because new cable was not available, various lengths and sizes of 13.6-kv. cable were assembled and spliced into the necessary lengths. The silfos soldering technique evolved consisted of six steps: First, half

A WORLD OF POWER!



As one of the few great names in Electric Power, it has been the province of Crocker-Wheeler to pioneer in the application of Electric Motors and Generators for many individual industries.

Today . . . as a part of the greater Joshua Hendy Iron Works . . . our enlarged productive facilities and specialized knowledge are more than ever available to all war industry.

Crocker-Wheeler Electric Manufacturing Company, Ampere N. J., Division of Joshua Hendy Iron Works.

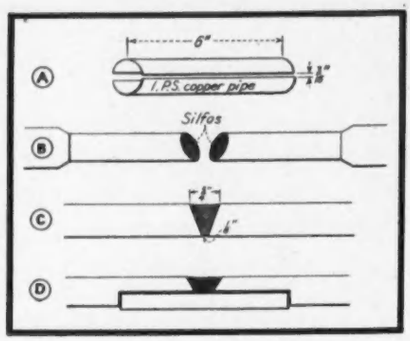
TRADE MARK REG. U.S. PAT. OFF.

CROCKER-WHEELER

SINCE 1888

sleeves were cut from i.p.s. copper pipe. The inside of the sleeves was coated with silfos. Next the cable ends were cut with a $\frac{3}{8}$-in. bevel and the insulation stripped back 12 in. from each end. The butts of the cable were coated with silfos.

A wide "vee" is necessary when



SILFOS soldering technique employed in making 17 splices to produce 200-ft. lengths of 1,250,000-cir.mil cable for emergency Boulder Dam installation

(a) Half sleeves made from copper pipe and coated inside with silfos. (b) Cable prepared for splicing. (c) Arrangement for silfos solder joint. (d) Application of sleeves to joint.

the cable ends are joined together because the heat is carried off so rapidly that the torch tip must be worked down into the joint. Otherwise the soldering is too slow. In this step the cable ends are brought within $\frac{1}{8}$ in. of each other and silfos applied from the bottom of the "vee" upward, taking extreme care to bond solder to the cable in the building-up process. Next the bottom half-sleeve is applied, using care to see that silfos flows between cable and sleeve along all edges. The top half-sleeve is then applied in a similar manner. Approximately $\frac{1}{2}$ lb. of silfos is required for each joint.

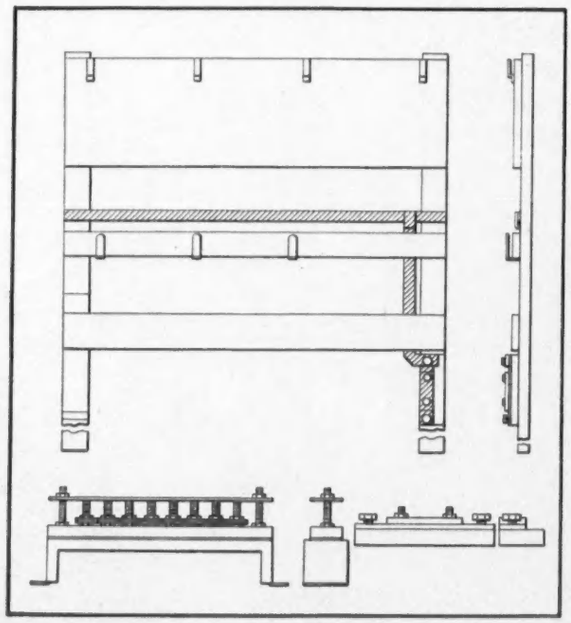
Finally 0.010 x 1-in. Irvington tape is wrapped around the joint to build up insulation equivalent to the original. The splice is finished off with one layer of $1\frac{1}{2}$-in. webbing tape which is sewed at each end to prevent slipping.

Because the cables varied somewhat in resistance and reactance phase balance was achieved by stacking transformer iron around individual leads as necessary. Flat copper busbar for connections between the cable and the generator and transformer buses was borrowed from emergency stocks at other Edison hydro plants.

•

Primary Metering Pre-Assembled

Time and expense in making 4,000-volt meter installations are saved by the Philadelphia Electric Company by the use of shop-assembled instrument transformer and meter units. The wiring contractor puts in, as integral parts of the customer's installation, steel cabinets, support structures and conduit according to company specifications fitting the particular job. Then the company installs completely wired instrument transformer and meter assemblies, to which the contractor has only to make primary connections.



SHOP-ASSEMBLED instrument transformer unit facilitates primary meter installation

The accompanying drawing of the frame used for holding current and potential transformers illustrates the idea. This frame, with transformers all wired up on it in the shop, is installed in the box provided for it on the job. The frame is welded together of shallow channels of No. 14 gage steel sheet. The two uprights, $3\frac{1}{4}$ in. wide and $47\frac{3}{8}$ in. high, have a channel depth of 1 in. The three cross-members have a channel depth of $\frac{5}{8}$ in. and are 35 in. long. The top one, which is drilled as indicated by the crosses to accommodate different types of potential transformers, is 10 in. high.

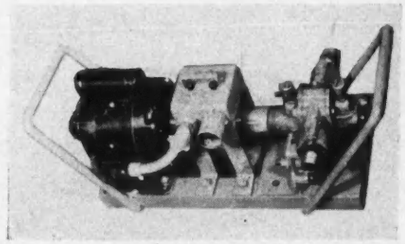
The middle cross-member, merely a stiffener, is $2\frac{1}{4}$ in. and the bottom one, drilled for the current transformers, has a height of $3\frac{1}{4}$ in. Just above the middle cross-member is a ground bus of 1 x $\frac{1}{8}$-in. copper which is fastened to the uprights by brass bolts and nuts. Brazed to the ground bus is a copper strip of the same size carried down to the ground or neutral terminal block on one leg of the frame. Across the top of the top cross-member are four clips which hold the potential transformer secondary wires. Three like clips on the middle member hold the current transformer secondaries. All the secondaries, completely color-coded, are brought down to a terminal block on the left leg.

With the assembled frame installed in the box all the wiring contractor has to do is to connect onto the current transformer primary terminals. The meter installer merely connects the color-coded test switch on the meter panel to the color-coded terminal block on the frame.

The installation is then ready for business.

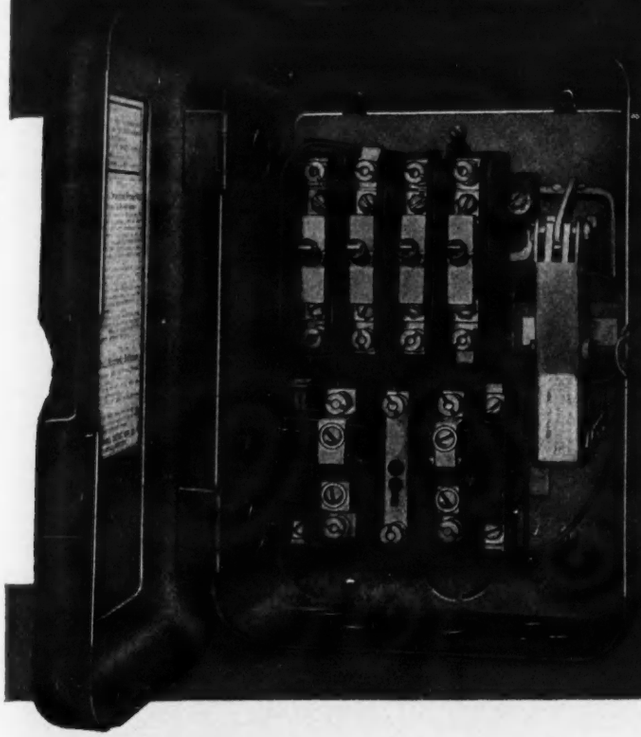
•

Reversible Oil Pump



By using a reversing (DPDT) switch with the $\frac{1}{2}$-hp. capacitor motor that drives this 15-g.p.m. gear-type oil pump flow can be reversed without changing hose connections. This portable pump set, used on the Oklahoma Gas & Electric Company system, was assembled by the reclamation department.

magnetics"



1. **STRAIGHT THRU WIRING**—line and load in same relative positions at top and bottom. No confusion.
2. **FRONT MOUNTING OF PARTS**—contacts always visible—never any question about proper contacting, nor danger to motor because of single phasing.
3. **EASE WITH WHICH CONTACTS CAN BE CHANGED** even by unskilled worker—no manipulations by expert mechanic necessary.
4. **NEVER HAS HAD TROUBLE WITH BURN-OUTS ON MOTORS**—one type he used "burned out five motors."
5. **OVERLOAD RELAYS ARE "HONEST"**—always trip on overload as claimed—he has used heaters whose performance has not been in accordance with calibration.

ADDED FEATURES OF "CM"

REMOVABLE INTERIORS: The entire mechanism is mounted on a steel back plate (aluminized finish) and can be removed as a unit by loosening three non-removable screws—for ease in wiring line and load.

SHOCK ABSORBING ARMATURE MAGNET ASSEMBLY: This shock-absorbing, self-aligning mechanism prevents hammer blows as the starter closes—assures long life, eliminates humming and minimizes coil maintenance.

SOLDERLESS LUGS: Sizes 0 and 1 are equipped with special "wire keepers", grooved on the inside to hold wire rigidly in place. Sizes 2 and 3 have Trumbull solderless "Handi-Lugs."

INTERCHANGEABLE RELAY HEATERS: All relay heaters, ½ to 80 amp., are interchangeable. Automatic reset standard, or hand reset on request.

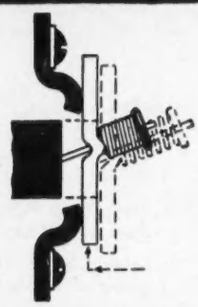
For long life and complete overload protection under severe load conditions specify Trumbull "CM" Magnetic Starters. *Ask for Circular No. 322 and Bulletin No. 404.*

VERTICAL CONTACTS

Pioneered by Trumbull

The Trumbull line of motor starters, both manual and magnetic has long been recognized as a major contribution to the Industry.

One of the best electrical and mechanical devices—Trumbull's vertical, sliding, self-wiping, double-break contact *was introduced by this company in 1927* and has been most effective because it keeps the contact . . .



DUST AND CARBON FREE

at all times. Note the vertical sliding action shown in the accompanying drawing, which wipes the metal *clean* at every operation of closing and opening the circuit. Non-carbonizing glazed porcelain bases also prevent accumulation of both dust and carbon.

AVAILABLE in Sizes 0 ("M"-2), 1 ("CM"-7½), 2 ("CM"-25) and 3 ("CM" - 50).

May be operated by either *remote, local or automatic control.* Also in combination with motor circuit disconnects, contactors and other equipment.

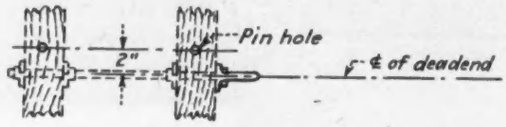
TRUMBULL

MAGNETIC STARTERS

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY . PLAINVILLE, CONN. . A GENERAL ELECTRIC ORGANIZATION

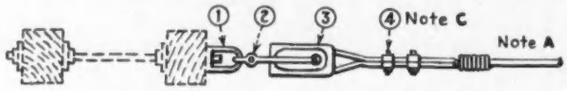
OTHER FACTORIES AT NORWOOD (CINN.) O. — SEATTLE — SAN FRANCISCO — LOS ANGELES

HOW TO MAKE SINGLE-WIRE DEADENDS* ON LINES UNDER 10 KV.

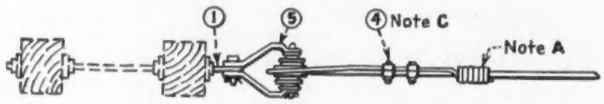


Attachment of deadends to crossarms

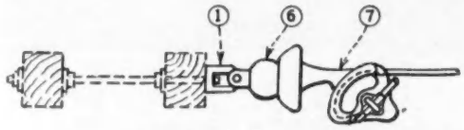
RURAL LINES—Amerductor No. 6



Std. 2452—Guy insulator deadend

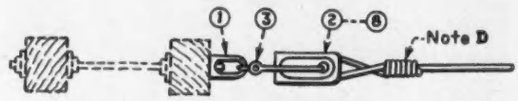


Std. 2453—Spool clevis deadend

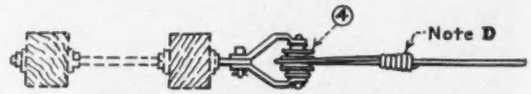


Std. 2454—Strain deadend

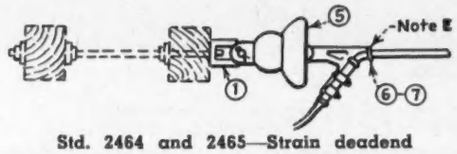
FOR COPPER WIRE



Std. 2462—Guy insulator deadend
No. 4/0 max. wire size, 4,600 volts max.



Std. 2463—Spool clevis deadend
No. 4/0 max. wire size, 4,600 volts max.



Std. 2464 and 2465—Strain deadend
350M cir.mil max. wire size, 7,500 volts max.

NOTES

A. Serve each copper strand five turns. Bend steel strand away from conductor and cut off.

B. Straight-line deadend, flexible clevis, item 8, may be used in place of two-bolt clamps, item 4, on Standards 2452-2453.

C. Two-bolt clamps, item 4, should be spaced 1 in. apart.

D. Serve six turns for No. 6 and No. 3 solid wire. For No. 1/0 and larger stranded wire, serve each strand six times around the conductor. Remove the insulation on TBWP wire and cover serving with four thicknesses of friction tape.

E. Remove weatherproof covering and scrape wire clean under strain clamp.

LIST OF MATERIAL

Item No.	Description	Quantity		
		2452	2453	2454
1	Bolt eye	1	1	1
2	Clevis, flexible	1	..	..
3	Insulator, guy	1	..	..
4	Clamp, two-bolt	2[a]	2[a]	..
5	Clevis, spool	..	1	..
6	Insulator, strain, 6 in	..	..	1
7	Clamp, deadend	..	..	1
8	Straight-line deadend	1[a]	1[a]	..

LIST OF MATERIAL

Item No.	Description	Quantity			
		2462	2463	2464	2465
1	Bolt eye	1	1	1	1
2	Insulator, guy, 1/0 max. wire size	1	..	..	..
3	Clevis, flexible	1	..	..	..
4	Clevis, spool	..	1	..	..
5	Insulator, disk, 6 in	..	..	1	1
6	Clamp, deadend, No. 2–4/0 wire	..	..	1	..
7	Clamp, deadend, 1/0–360M cm.	..	..	..	1
8	Insulator, guy, 2/0–4/0 wire	1	..	..	..

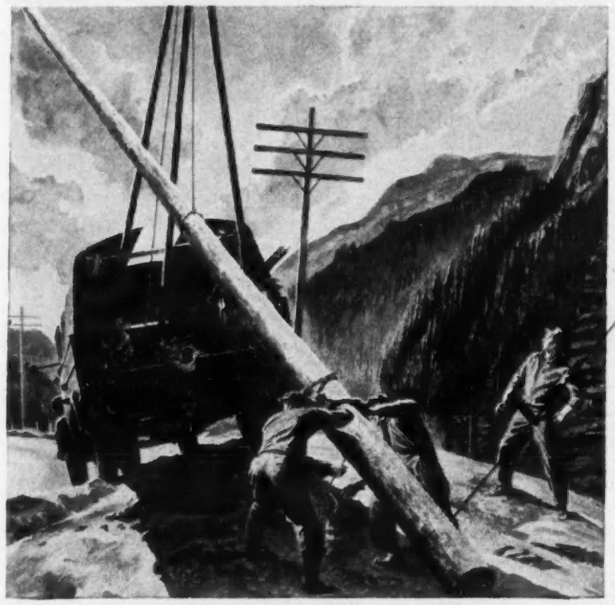
[a] Optional, see note B.

*From a book of standardized practices of New England Power System

Protect wood products from insects and decay

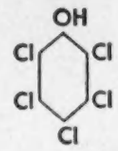
Dowicide 7 in oil solutions has shown outstanding promise and is finding an increasing use as a highly effective and permanent oil preservative for many wood products. The treated wood is clean, non-bleeding, paintable, and easily handled by workmen. The preservative oil solution penetrates better and is more uniformly distributed throughout the wood than in the case of higher viscosity oil preservatives.

Dowicide 7 is one of a group of seventeen industrial germicides and fungicides developed by Dow. These products have rendered extensive service to paper, textile, leather, petroleum, lumber and other industries.



DOWICIDE 7

Pentachlorophenol, Technical



PROPERTIES: Form: Dark colored flakes and sublimed needle crystals with characteristic odor.

Molecular Weight	266.4
Freezing Point	179.5-182°C.

PACKING: Barrels; 275 pounds net, 300 pounds gross.

SHIPPING CLASSIFICATION: Disinfectants other than medicinal, N. O. I. B. N.

SOLUBILITY IN GRAMS PER 100 GRAMS SOLVENT:

Acetone at 25° C.	53
Benzene at 25° C.	11
Butyl Carbitol at 25° C.	156
Butyl Cellosolve at 25° C.	150
Carbon Tetrachloride at 25° C.	4
Castor Oil at 25° C.	17
Coal Tar Creosote (AWPA No. 1) at 25° C.	54
Coconut Oil at 25° C.	40
Cotton Seed Oil at 25° C.	35
Deo Base Oil at 25° C.	4
Diacetone Alcohol at 25° C.	193
Dibutyl Phthalate at 25° C.	70
o-Dichlorobenzene at 25° C.	12
Diglycol at 25° C.	100
Ether at 25° C.	148
Ethyl Alcohol (Formula 30) at 25° C.	143
Fuel Oil at 25° C.	12
Light Mineral Oil at 25° C.	2
Linseed Oil at 25° C.	26
Menhaden Oil at 25° C.	36
Methanol at 25° C.	57
Neat's Foot Oil at 25° C.	22
Olive Oil at 25° C.	19
Perilla Oil at 25° C.	38
Petrolatum (White) at 25° C.	2
Pine Oil at 25° C.	89
Soy Bean Oil at 25° C.	35
Sperm Oil at 25° C.	20
Stoddard Solvent at 40° C.	4
Toluene at 25° C.	14
Turkey Red Oil at 25° C.	8
Turpentine at 25° C.	10

FUNGICIDAL EFFICIENCIES:

	% for Inhibition	% for Kill
Rhizopus nigricans	0.035 -0.05	0.035 -0.05
Rhizoctonia solani	0.001 -0.002	0.001 -0.002
Chaetomium globosum	0.002 -0.0035	0.002 -0.0035
Hormiscus gelatinosum	0.0075-0.01	0.01 -0.02
Aspergillus No. 29	0.001 -0.0025	0.01 -0.025
F. P. L. No. 517	0.001 -0.002	0.002 -0.0035
Aspergillus flavus	0.002 -0.005	0.005 -0.01
Lenzites trabea	0.001 -0.002	0.001 -0.002
Ceretostomella pilifera	0.002 -0.0035	0.002 -0.0035
Trichophyton interdigitalis	0.0005-0.001	0.0005-0.001
Trichophyton rosaceum	0.0025-0.005	0.05 -0.1
Poria luteofibrata		0.001 -0.0025

THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN

New York • Chicago • St. Louis • Houston • San Francisco • Los Angeles • Seattle

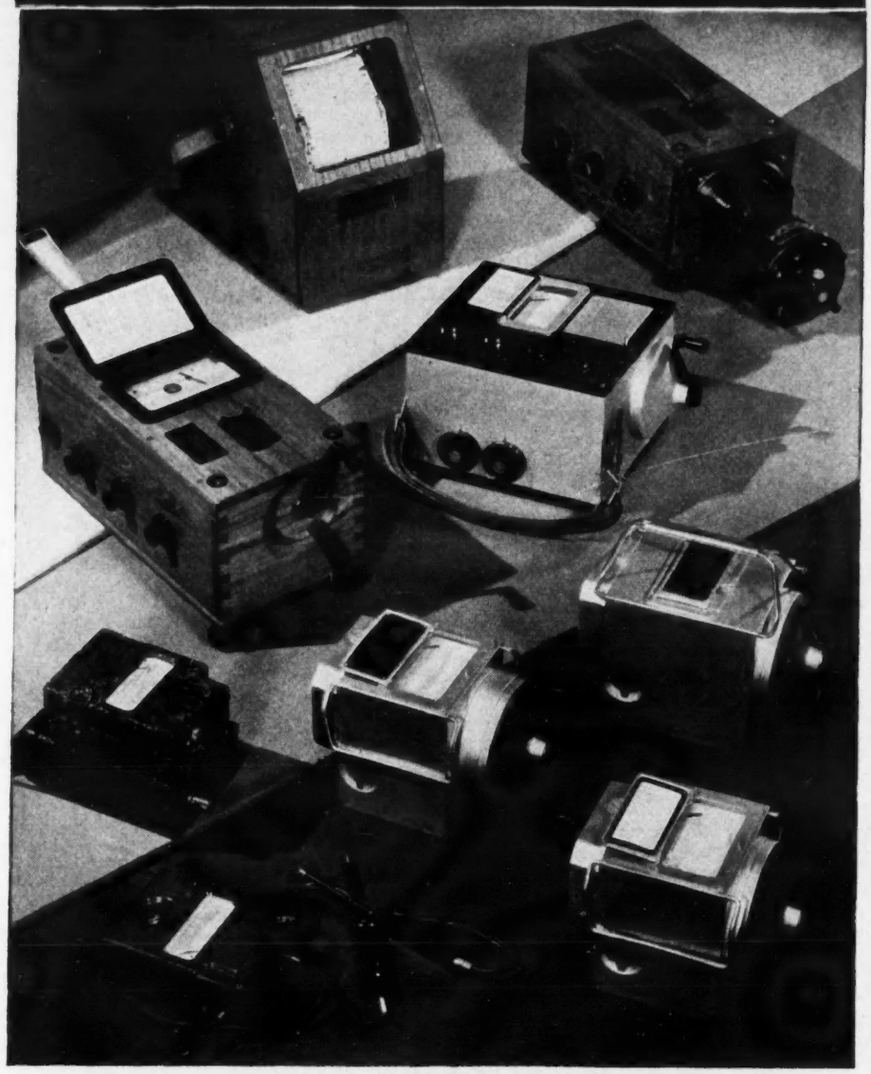
DOWICIDE

GERMICIDES AND FUNGICIDES

DOW

CHEMICALS INDISPENSABLE TO INDUSTRY AND VICTORY

"MEGGER"
TRADE MARK REGISTERED U.S. PAT. OFF
Insulation Testers, Ground Testers and Ohmmeters



Today's Events
are emphasizing the importance and the dependability of these world-famous testing instruments, for detecting and preventing trouble in electrical equipment.

We urge you to inform us as soon as possible of your requirements for "Megger" instruments.

Write for—(no charge):

Pocket Manual of "Megger" Practice No. 1420-W
Technical Bulletin on Ground Testing No. 1285-W
Ducter Ohmmeter (for quick measurements of very low resistance) Bulletin 1635-W

James G. Biddle Co.
1211-13 ARCH STREET Electrical and Scientific Instruments PHILADELPHIA, PA.

Maintenance of Insulating Oil

VII. Color Factors*

By L. M. LIMPUS
Superintendent of Reclamation, Oklahoma Gas & Electric Company

Oil color, like acidity, follows no definite rule with respect to oil oxidation. It is, however, another indicator of oxidation progress and often follows the increase in neutralization number within the range of a fairly well-defined ratio. As some laboratories prefer to express neutralization numbers in NaOH rather than KOH, so we prefer to express color measurement in iodine numbers rather than standard ASTM or NPA numbers—the colors may be graded much more closely. A conversion chart was published in the Kansas City Testing Laboratory Bulletin No. 25, July 19, 1939, with the iodine number expressed as the parts per million of iodine in water. Ordinarily a color number of 200 to 500 will indicate a neutralization number of low value and an absence of sludge. The color of a new light amber oil is generally logged as 200 minus. Likewise a color number of 1,500 to 2,500 will generally indicate a neturalization number of 0.5 to 0.75 and some sludge, while color numbers as high as 4,750 often indicate a very severe sludge condition.

Causes of Color Changes

Color change seems to be a result of oxidation, exposure to sunlight and the absorption of oil soluble materials used in the insulation of electrical apparatus. The color change caused by oxidation appears to result from the formation of petroleum resins which remain dissolved in the oil, and may or may not contribute to sludge formation. Although these resins are easily removed and measured by selective absorption on decolorizing clay, it is quite difficult, if not impossible, to separate them from the coloring matter dissolved out of the insulating materials, and the true value of color measurement is still questionable. The real value of color and acidity measurements depends in a large degree upon the experience of the operating engineer and his knowledge of the oxidation characteristics of the particular oil

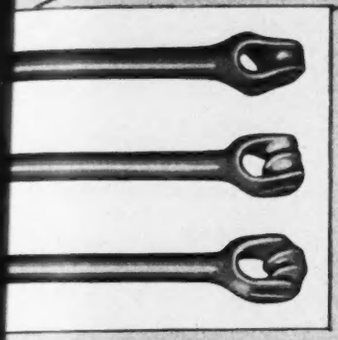
*This series began in the October 31 issue of "Electrical World."

. . . from the
COMPLETE LINE OF
OLIVER
POLE LINE MATERIALS

OLIVER
GUYING MATERIALS
EASY TO INSTALL . . . HOLD TIGHT

BEST FOR 1943 . . .

Long life and easy installation are features of Oliver Guying Materials that make these dependable products your best choice for 1943. Complete lines include types and sizes for all requirements.



ANCHOR RODS . . .

Oliver Anchor Rods and Anchors are available in many types, sizes and lengths to meet the needs of various anchoring conditions. Thimbleye and Twin-eye types available as well as regular oval eyes. All are hot dip galvanized.

GUY SHIMS, PLATES, HOOKS, BOLTS

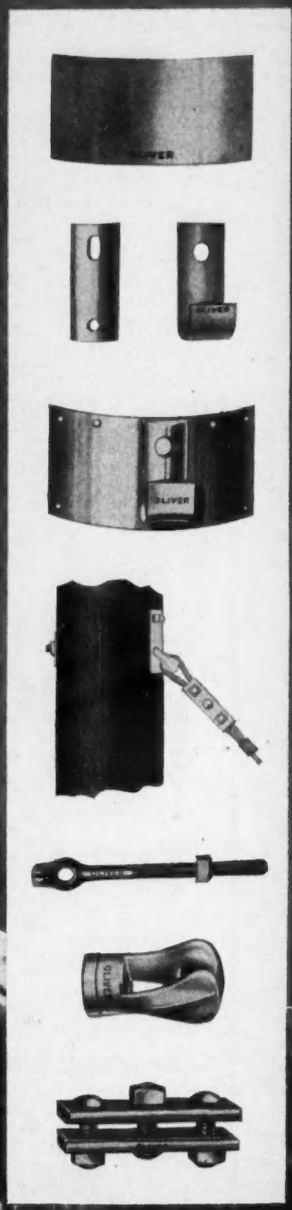
Considerable flexibility in the method of attaching the guying strand to the pole is afforded by Oliver equipment. In addition to a complete line of shims, strain plates, guy hooks and lag screws, Oliver makes angle Thimbleye Bolts in various sizes and lengths for guying. Because they speed pole erection and save materials, Thimbleye Angle Bolts are gaining widespread popularity.

GUY WIRE PROTECTORS

"Bierer" guy wire protectors are made of heavy gauge steel, hot galvanized. They prevent damage to guy wires and protect the public from the dangers of exposed wires. Provided with simple, effective clamping devices that are easily attached and hold tight.

GUY CLAMPS

Oliver Guy Clamps are made from hot rolled, open hearth steel. Furnished in light and heavy types, and in three lengths in each weight. Long, smooth clamping surface gives greater holding power.



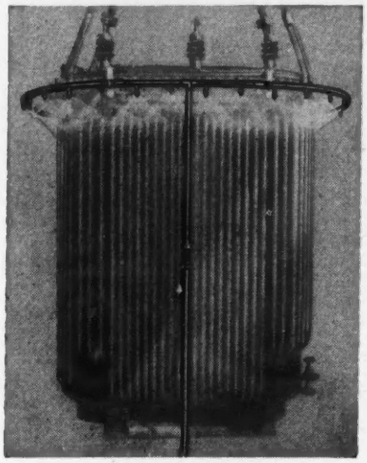
HOT-DIP GALVANIZING

OLIVER
IRON AND STEEL
Corporation
Makers of Pole Line Materials Since 1894
PITTSBURGH, PENNSYLVANIA

Cooperating in War Production

ALL FOR VICTORY
OLIVER '42

Be Prepared for Transformer Overloads



Use BROOKS SPRAY RINGS

- Instantly ready for emergency use.
- No alterations required to install.
- No moving parts requiring service.

WRITE

for catalog and engineering test report today.

JOHN A. BROOKS
SPRINKLING SYSTEMS
20122 Livernois Ave.
DETROIT, MICHIGAN
Patented Spray Devices Since 1915

examined, and the manner in which these characteristics are affected by the particular apparatus from which the oil was removed.

It is well to add here that old operators, knowing nothing of colors and acidities, relied upon the odor of the oil to determine its degree of deterioration, and there is still much merit in such reliance. Although one usually cannot describe odors, an experienced operator can often tell you a great deal about your oil by merely smelling it. Highly deteriorated oils smell sour.

•

Rig Cleans Moss From Hydro Flumes

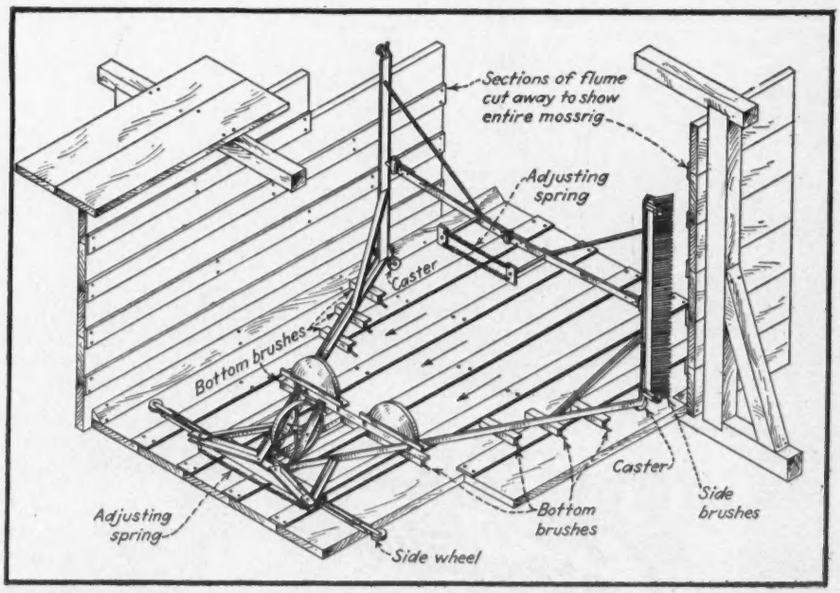
By A. F. FRONTZ
Foreman, American River Power House, Pacific Gas & Electric Company

Water supply for the operation of three hydro-electric units in the American River power house of the Pacific Gas & Electric Company is delivered into the forebay at the entrance to the penstocks through a combined ditch and flume installation totaling 7.26 miles in length. Of this distance 4.92 miles is a wood flume structure with a cross-section varying from 5 ft. 6 in. to 7 ft. in width and from 6 ft. to 5 ft. in depth. The average grade is 1 ft. per thousand and the rated flume capacity is 160 cfs.

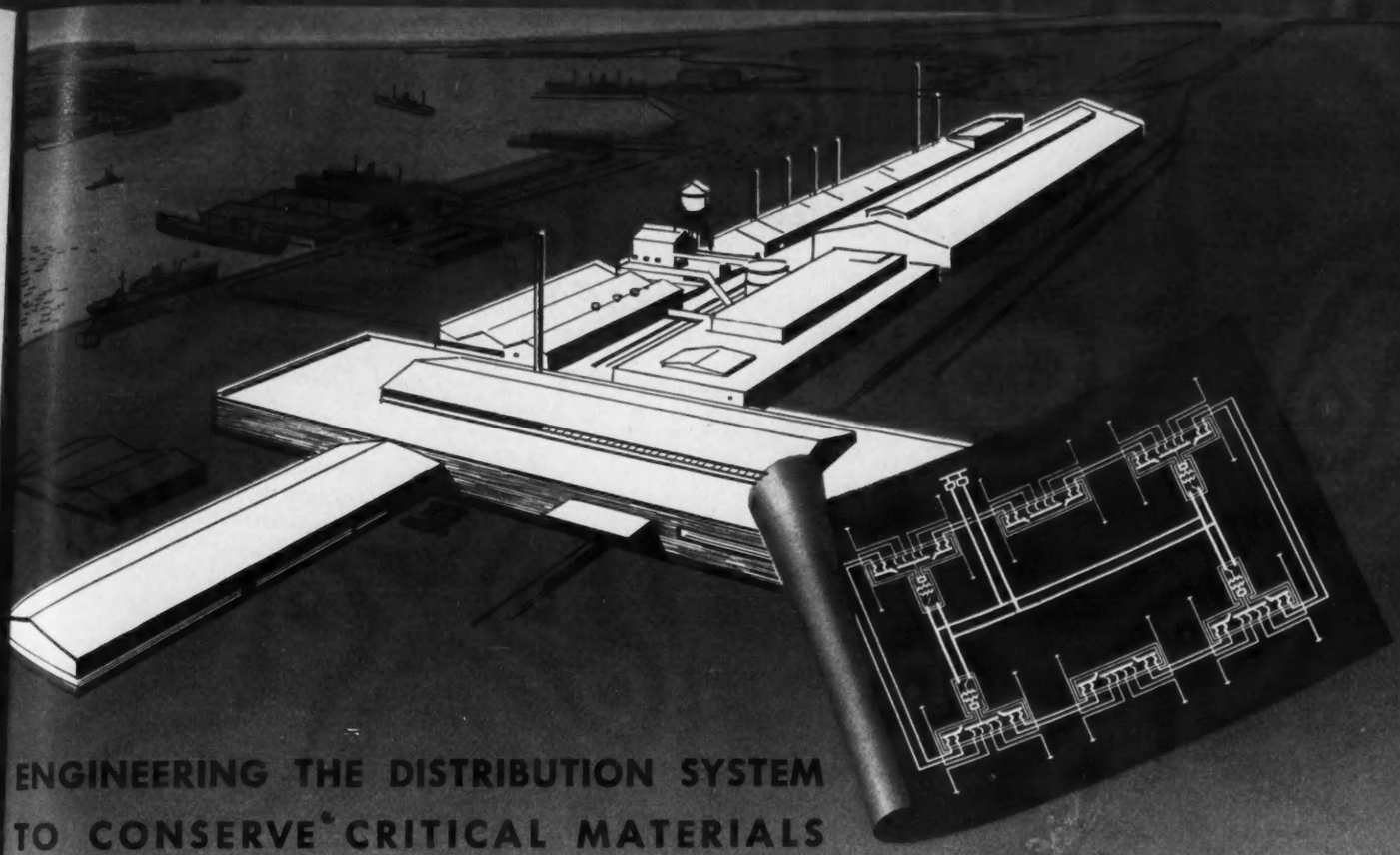
One of the maintenance problems incidental to the operation of this flume is the removal of rapidly growing moss or algae, which seriously affects its carrying capacity. The active algae-growing period extends for about 9 months of the year and reduces the flow by as much as 10 percent if not removed. This results in a loss of some 400 kw. of generator capacity, which is of serious moment in a plant operating on a yearly load factor of almost 82 percent to produce in excess of 41,000,000 kw.-hr. annually.

Unsuccessful attempts were made to control the growth of the algae by the introduction of copper sulphate into the water, using as much as 150 lb. per week. It was frequently necessary to turn the water out of the flume, thus shutting the power house down completely for approximately 10 hours while the growth was manually removed from the flume with brushes and stiff brooms. This entailed an expenditure of some $200 in addition to the loss of about 50,000 kw.-hr. in plant output.

The problem was solved by the construction of a "moss rig" built up of miscellaneous materials available at the power house and shown in the accompanying sketch. It consists of a more or less flexible device supported on a single large front wheel and a pair of casters in the rear, which carries steel rakes with hooked ends so arranged that they will cover the entire wetted perimeter of the flume. The moss rig can be introduced into the flume at the upstream end



ISOMETRIC VIEW of current-propelled adjustable moss rig for removing algae from bottom and side of flumes; use added 1,000,000 kw.-hr. annually to power house output and saved cost of copper sulphate



ENGINEERING THE DISTRIBUTION SYSTEM TO CONSERVE CRITICAL MATERIALS

Saved 11 tons of copper

HOW WESTINGHOUSE CAN HELP YOU SAVE TIME • CRITICAL MATERIALS

- **Selecting the Right System**—Wide application experience in all types of industries enables Westinghouse engineers to recommend the distribution system best fitted to your plant.
- **Air-Cooled Transformers**—permit location close to load centers with maximum safety, eliminate expensive vaults.
- **Hipersil**—an exclusive Westinghouse development with ⅓ more flux-carrying capacity than ordinary silicon steel. Reduces transformer size and weight.
- **Loading by Copper Temperature**—permits use of *all* the transformer capacity, with complete protection against burnouts.
- **Improving Power Factor**—through use of capacitors, can often save installation of new feeder lines. Westinghouse engineers are in a position to make such practical recommendations.

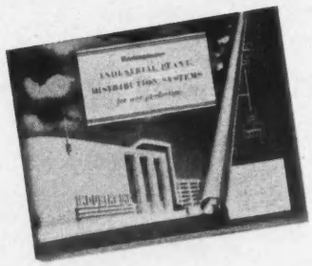
A vital war plant faced the problem of providing reliable power supply. The distribution system originally planned required 70,600 pounds of copper.

By recommending a plant network system custom-fitted to the job, Westinghouse engineers were able to provide greater flexibility with increased sabotage protection—using *only* 48,400 pounds of copper. Result: 22,200 pounds of critical material saved—more than 11 tons.

Westinghouse plans and builds *all* types of distribution systems. Thus broad engineering experience is brought to bear on your particular problem. The final recommendation is based on nature, density and location of load—and critical material saved. All systems recommended are designed to use standard distribution equipment. No time is lost in building special apparatus.

For prompt action, call our local office. Or send for the helpful booklet below. Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

J-94534



UP-TO-DATE FACTS ABOUT DISTRIBUTION SYSTEMS

Keep up-to-date on latest plant distribution systems. Send for this 24-page Book, B-3152, which briefly describes different plant distribution systems, and points out the advantages of each.

Westinghouse **PLANT DISTRIBUTION SYSTEMS**

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

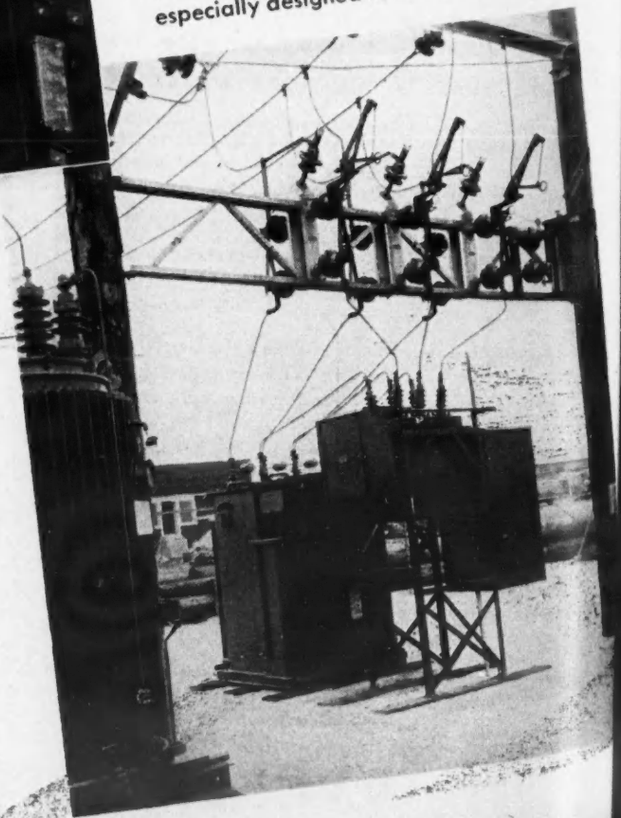
Expediting Essential Power— from Producer to User . . . via ROLLER-SMITH *Equipment*

Protecting the auxiliary equipment that makes a power plant function . . . defending the transformers at the distribution station . . . bearing the brunt of short circuits and overloads on low-voltage feeders in war plants . . . these are the jobs for which Roller-Smith metal-clad switchgear, air and oil circuit breakers have proved themselves eminently suited.

Tested in the Roller-Smith Circuit Breaker Test Station under conditions more severe than are ever encountered in service . . . proved by years of operation in hundreds of installations . . . approved by discriminating engineers in the electric power and industrial fields . . . these products today are expediting . . . and safeguarding essential power from the generator to the driven machine.

METAL-CLAD SWITCHGEAR

Built to meet the exacting requirements of each installation R-S switchgear embodies such features as: molded insulated bus on 15 KV units . . . ample space for mounting relays and instruments . . . individual bakelite isolating enclosures for primary disconnects . . . silver-to-silver, full-floating, self-aligning secondary contacts . . . high-pressure, self-aligning disconnecting devices especially designed for easy inspection.

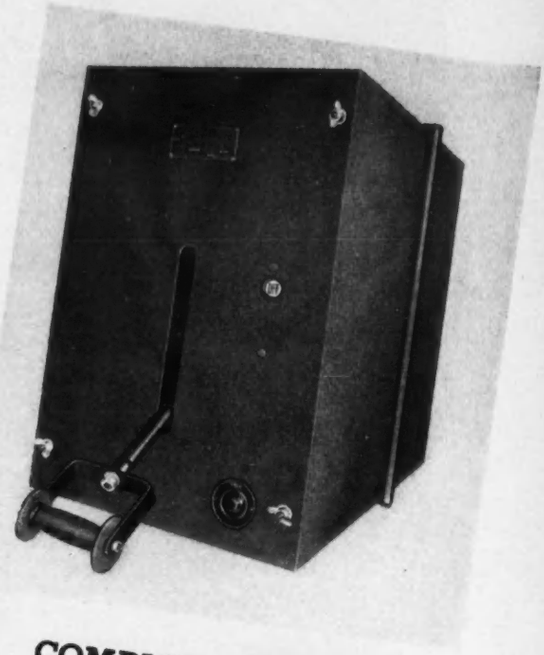


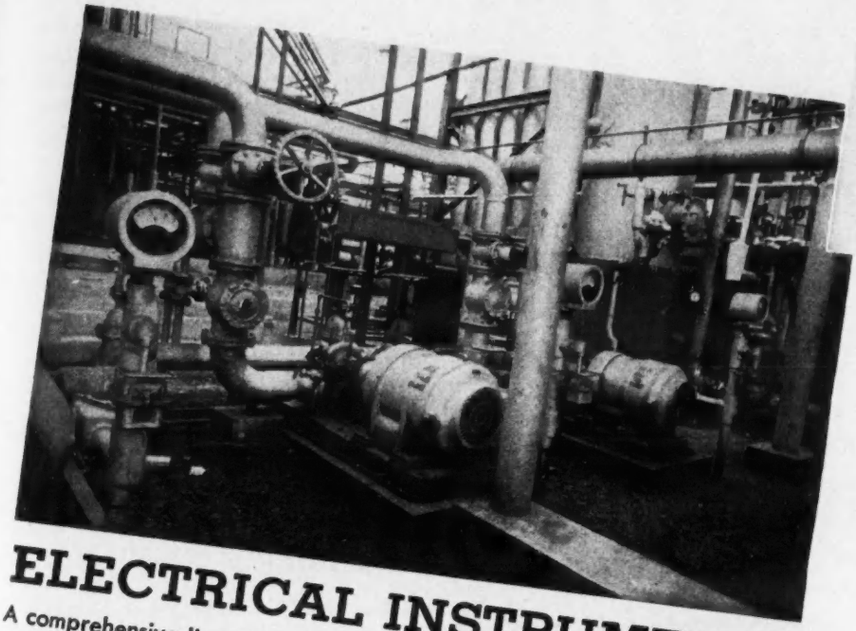
OIL CIRCUIT BREAKERS

For indoor or outdoor service, Roller-Smith oil circuit breakers meet the standards of NEMA and the AIEE. Indoor breakers in ratings from 200 to 2000 amperes are available in voltages up to 15,000 volts and interrupting capacities to 250,000 KV-a. Outdoor breakers can be furnished in ratings up to 2000 amperes, voltages to 23 KV, and interrupting capacities to 250,000 KV-a. In all classes of service these breakers have compiled an enviable record for trouble-free operation, which is attested to by the number of repeat orders constantly being received. Full information regarding the features, construction and ratings of each class of breaker can be obtained on request.

AIR CIRCUIT BREAKERS

For the protection of low-voltage circuits requiring interrupting capacities up to 100,000 amperes and current carrying capacities to 6000 amperes at 600 volts a-c and 10,000 amperes at 250 volts d-c Roller-Smith provides a time-proved line. Inverted main, secondary and arcing contacts prevent all danger of contacts blowing open on short circuits. Silver-plated main contacts prevent oxidation . . . tungsten alloy arcing contacts resist the effects of frequent arcs.



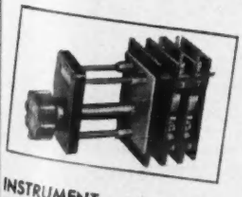


COMPLETE DATA . . . . .

on the products briefed on these pages . . . and on all other R-S products as well can be obtained by calling our representative near you or writing Roller-Smith, Bethlehem, Pa.

ELECTRICAL INSTRUMENTS

A comprehensive line of switchboard, panel and portable ammeters, voltmeters, milliammeters, wattmeters, frequency meters and other electrical instruments are giving visual indication of circuit conditions on switchboards and equipments throughout the world. Built to exacting standards of precision and electrical accuracy, these instruments show the background of 35 years of fine instrument making. Illustrated above is a Roller-Smith development—an explosion-proof ammeter for hazardous locations where the ordinary meter would not long survive.

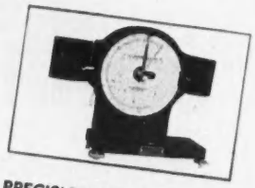


INSTRUMENT and CONTROL SWITCHES—A complete line of 88 standard combinations. Rugged . . . durable . . . reliable.

THERMO-MAGNETIC RELAYS for motor control. Match motor thermal characteristics. Prevent unnecessary interruptions yet protect the circuit.

CIRCUIT TESTERS. Inexpensive . . . reliable. Determine whether circuit is complete.

GRAPHIC INSTRUMENTS for recording circuit conditions. Switchboard or portable type.



PRECISION BALANCES. For fast, accurate weighing of particles from 5 MG to 50 grams.

ROLLER SMITH

Electrical Measuring and Protective Apparatus

ROLLER-SMITH COMPANY BETHLEHEM, PENNA.

Switchboards • Metal Enclosed Switchgear • Electrical Instruments
Indoor and Outdoor Oil Circuit Breakers • Air Circuit Breakers

When there's a Fire!

C-O-TWO

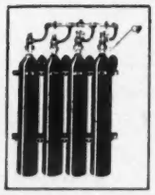
CAN TAKE IT—AND DISH IT OUT

The fact remains that when a fire occurs the equipment that can stand up to it and put it out in the shortest possible time is the most positive—the most dependable assurance against loss of time and damage to materials and equipment.

C-O-TWO has come a long way since the haphazard fire fighting methods of yester-years. C-O-TWO is selective. It is the modern method of killing fires in split seconds with carbon dioxide—the fastest non-damaging fire extinguishing agent. C-O-TWO is specified and approved for oil, gasoline, alcohol, paint lacquer and electrical fires. There are C-O-TWO automatic and manual systems, portables, wheeled and hose reel types to fit particular risks. C-O-TWO kills fires—saves lives and time.

Fixed hose reel type with 25 feet of fast uncoiling, non-kinking hose, will put out fires in electrical machinery, dip-tanks or storage vaults.

With C-O-TWO hand and wheeled type portables, carbon dioxide is directed at the base of the fire, it's out—without damage—in seconds.



Permanently installed automatic or manual system may be engineered to protect one or more spaces with just one C-O-TWO installation.

C-O-TWO is a registered trade mark. To be safe, specify C-O-TWO and this company's name when ordering.

C-O-TWO FIRE EQUIPMENT CO.

NEWARK, NEW JERSEY

Sales and Service in the Principal Cities of United States and Canada

and the velocity of the water will carry it along, effectively cleaning bottom and sides en route.

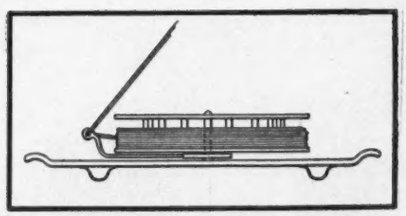
The machine traverses the flume about once each week, being handled by the foreman and three men of the regular flume maintenance and operating force. The net result has been an average increase in plant capacity of 200 kw., with an annual increase in output estimated to be somewhere between 750,000 and 1,000,000 kw.-hr. The saving of money formerly spent for copper sulphate will amount to several hundred dollars each year.

The moss rig requires little or no maintenance and the operating personnel are only needed to place it in position at the upstream end of the flume and remove it when it has reached the lower end and haul it back in readiness for the next trip. In these days, when every available source of power should be tapped and all resources conserved to the all-important task of winning the war, such homely devices as the one herein described play a humble but nevertheless important part.

•

Self-Braking Wire Reel

Ever since the first grunt burned his fingers by using his hand as a brake, men have been exercising their ingenuity to devise a means for stopping the over-run of a reel of wire when the pull is slacked off. Comes now the overhead lines department of the Durham (North Carolina) Public Service Company with its solution of the problem.



REEL BRAKE tightens when wire tension is released

As appears in the sketch, the reel is mounted on a hand-carry frame. Fixed to the axle of the reel is the drum of an automobile brake, the brake band to the frame. The brake operating cam is fastened to a lever which terminates in a ring or eye. A

spring pulls back on the lever, holding the brake tight.

A coil of wire is placed on the reel and its inner end fastened thereto. The outer end of the wire is passed through the ring on the end of the lever. Now, when the wire is pulled, the tension moves the lever, releasing the brake. When the tension is removed the lever is pulled back by the spring and the brake is applied.

•

Tubes Lightning-Proof Existing 13.8-Kv. Line

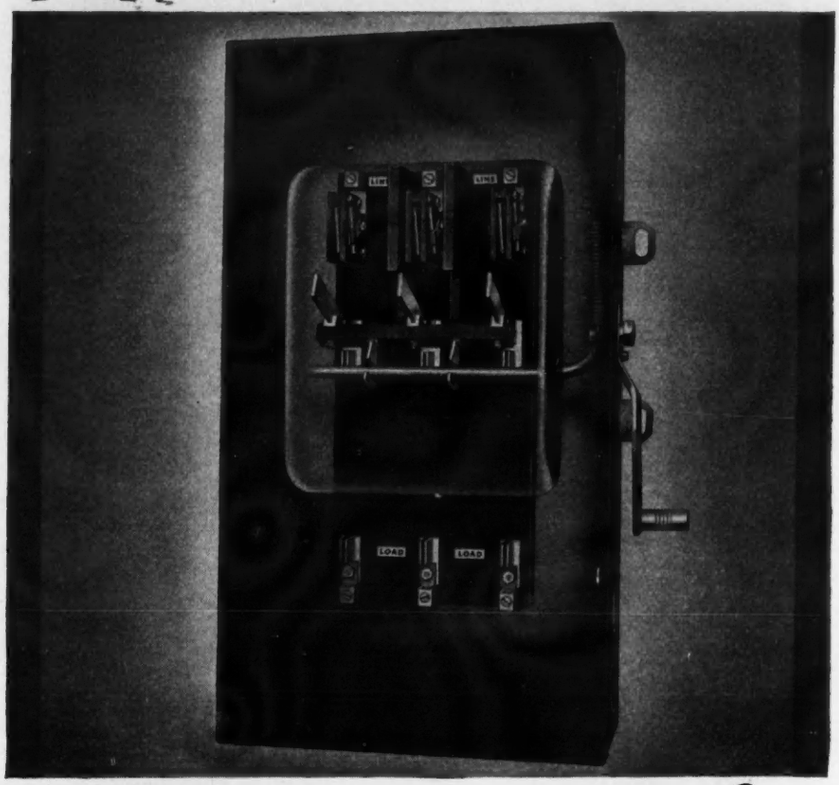
Protector tubes installed on the top phase wire of a short but important 13.8-kv. sub-transmission line on the Des Moines Electric Light Company system have brought this circuit through 1½ lightning seasons without a trip-out due to lightning. Only trouble on this 4.5 mile line, which serves two Des Moines, Iowa, radio stations and acts as an emergency feed to the 3,750-kva. East Des Moines substation, occurred when a bird "shorted" out the tube and grounded the top phase wire temporarily.

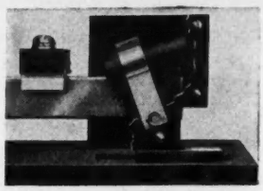
The triangular configuration of the No. 4/0 copper conductors—with the "ridge" about 8 ft. above the two bottom phases—made it possible to install type T Deïon protector tubes on the top phase wire and use it for a shield wire with a shielding angle of about 30 deg. Tubes, 60 in number, were installed at 300 to 400 ft. intervals—but not further apart than 500 ft.—and were connected, through a resistor and No. 6 weatherproof ground wire in wood molding, to a ground at each pole. Average ground resistance was under 5 ohms and was obtained in most cases by driving two ⅝-in. x 10-ft. rods 2 ft. and 8 ft. from the base of the pole and connecting them by a single ground wire buried some 18 in. deep.

Since this line originates at one of the Des Moines generating stations back-up capacity in case of a phase-to-ground fault was considerable. Therefore, a resistor was installed in series with each protector tube to limit the short-circuit current to a value that would not rupture the tube. This resistance, however, was not high enough to cause flashover between the phase wire and ground.

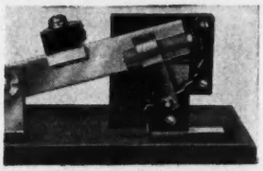
Favorable experience with this short "sample" line during the past

IT'S YOUR PIGEON, TOO, MISTER

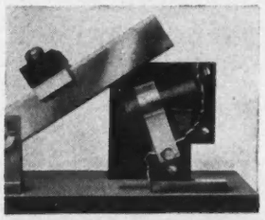




View of Rolarc snuffer showing blade in full engagement with live contacts before passing thru rollers towards OFF position.



View of Rolarc snuffer showing blade at point of final disengagement from live contact jaws.



View of Rolarc snuffer showing blade after disengagement from live contact and rollers. Rollers snapped together again obstructing path of possible arc.

THE FEDERAL Rolarc

..DESIGNED TO DO THE JOB

Winning the war is our problem—our job as much as it is the job of the men manning the guns. It's our "Pigeon"—and yours.

To get the job done—to help do it faster and better—Federal developed the 575 Volt Rolarc Safety Switch. Here's a dependable, hard working switch, 100 to and including 600 ampere capacity, built to carry the load.

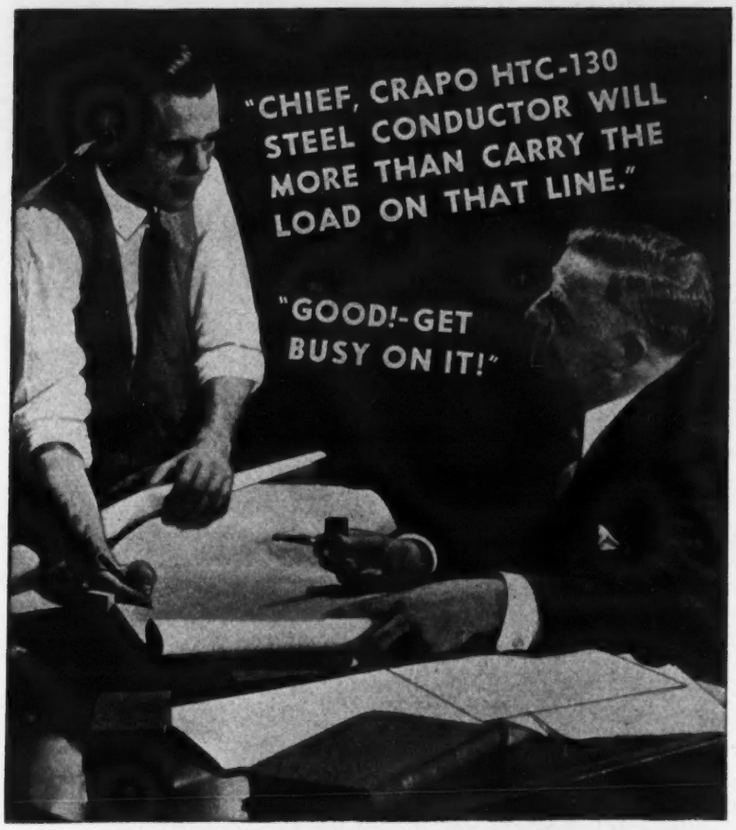
Engineered on an entirely new principle of arc control, the Rolarc reduces the possibility of arcing to an *absolute minimum.* It lengthens switch life and conserves war-vital copper . . . it increases the safety factor and saves priceless time and power by eliminating dangerous arcing . . . it increases production by eliminating delays caused by switch failure.

If production is "your pigeon" let the Federal Rolarc Safety Switch help get the job done. *Get all the facts—write for bulletin 42-12.*

Until stocks on hand are exhausted we must reserve the right to ship our regular 575 Volt Safety Switch unless Rolarc is specified on the order.

FEDERAL ELECTRIC PRODUCTS CO.
54 PARIS STREET NEWARK, N. J.

PANELBOARDS • SWITCHBOARDS • SAFETY SWITCHES • CIRCUIT BREAKERS



IMPROVED STEEL CONDUCTORS MEET WAR-TIME NEEDS

● *Crapo* HTC-130 Steel Conductors---"proved in" during peace-time on rural power lines---are serving a wide range of applications in the war emergency.

● Transmission and Distribution Engineers, faced with shortages of other critical materials, are discovering that these superior galvanized steel conductors have load-carrying capacity far beyond their expectations---and their needs.

● *Crapo* HTC-130 Steel Conductors provide a combination of electrical and physical characteristics never before available in ferrous wire. Their unique electrical advantages include relatively low 60-cycle resistance, low magnetic permeability and low 60-cycle reactance. Their high tensile strength makes possible extra long spans, reduces the number of pole structures required, saves valuable man-hours and material.

● Ask representatives of Graybar Electric Co., Inc., Distributors, for complete information about these conductors; or write direct for technical booklets!

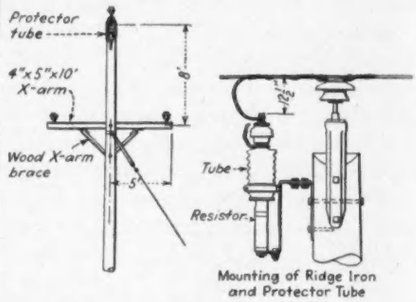
INDIANA STEEL & WIRE COMPANY
MUNCIE, INDIANA

Manufacturers of *Crapo* Galvanized Conductors, Steel Strand, Telephone and Telegraph Wire.

Crapo HTC-130 STEEL CONDUCTORS

lightning season—which was unusually severe in Iowa—has led the company to favor the use of protector tubes for improving service on a 30-mile, 46-kv., flat-configuration line already in service. It has been decided to install tubes on each of the three conductors every third pole on this line instead of changing arms and adding a bayonet for an additional overhead shielding wire to protect the line from lightning.

It was recognized that provision of a well-grounded shield wire in the design of new line may generally be expected to give somewhat better performance than protector tubes. However, in this case of an existing line,

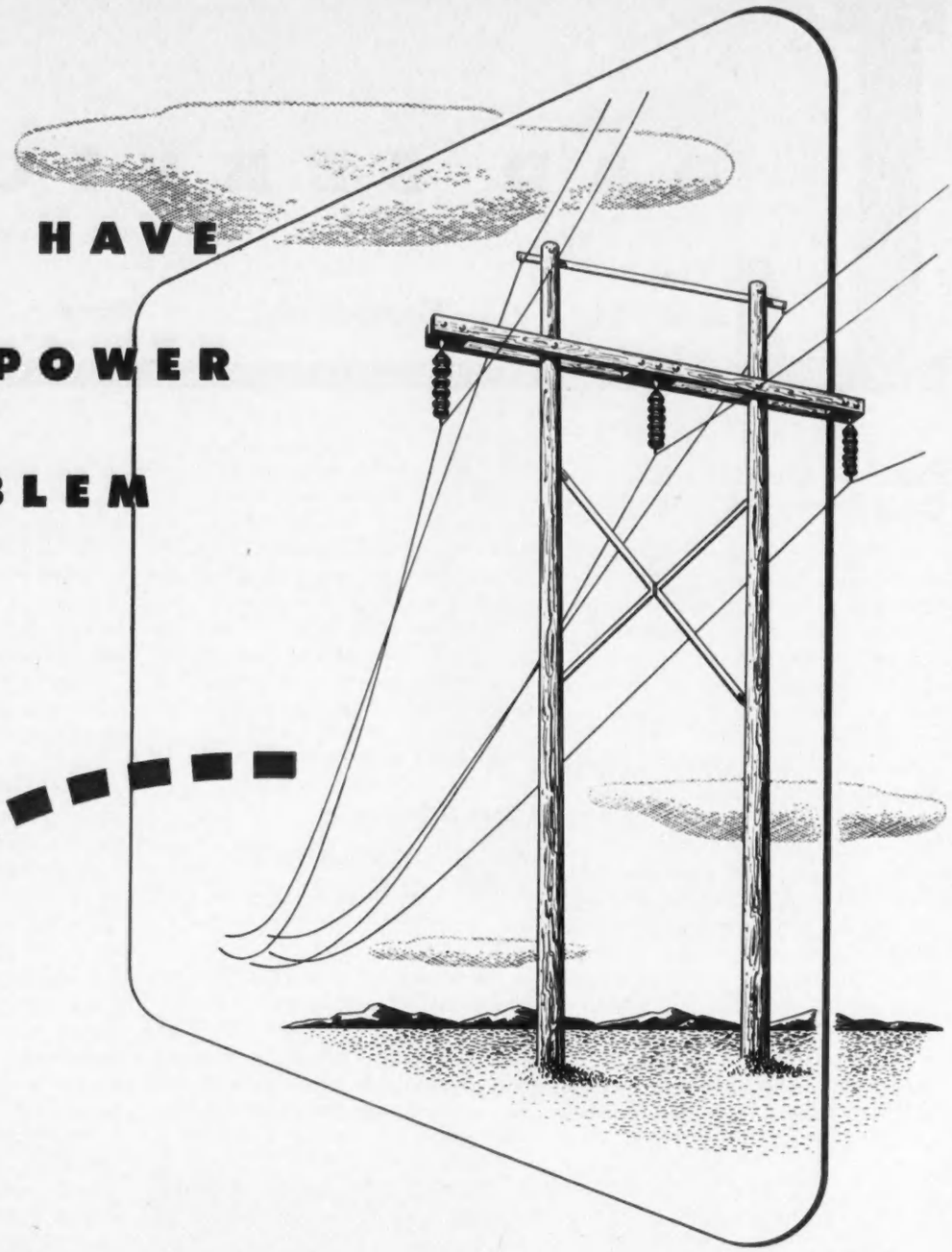


PROTECTOR TUBES convert ridge conductor of existing 13.8-kv. line shield wire for lightning protection

considerations of conductor availability for the shield wire and the increased cost of a shield wire superposition construction as against protector tubes favored the use of tubes. Cost of protecting this present 46-kv. line with tubes as against adding a shield wire superposed by means of bayonets figured out about $250 per mile cheaper.

If the 30-mile line referred to were, in fact, a newly contemplated line, the extra cost of such construction with proper pole height, overhead shield wire, grounds and everything complete for lightning protection would exceed the cost of a simple line with one crossarm and pole-top pin, not lightning proofed, by about $800 per mile. This simple line would correspond to the presently existing 46-kv. line to which tubes are to be added. The job of adding tubes to the existing line will cost in the neighborhood of $675 per mile. If a new line for 46-kv. service was to be built company engineers state that it is "probable" that the extra $125 would be spent to get overhead shield wire protection.

IF YOU HAVE A MANPOWER PROBLEM



. . . let us help you. Our trained men and special equipment combine to help you meet today's increased demand for power. Whether yours is a problem of erection or maintenance . . . regardless of distance or terrain . . . you'll find Hoosier service efficient and economical.

HOOSIER ENGINEERING

ERECTION and MAINTENANCE OF TRANSMISSION LINES

NEW YORK 46 S. FIFTH ST., COLUMBUS, OHIO CHICAGO

LOAD SERVICING

Industrial • Commercial • Rural • Residential

Fuse Demonstration Cuts Service Calls

In peacetime, like many other companies, the Interstate Power Company, Dubuque, Iowa, rendered fuse service to its customers for a nominal charge. Now, however, inroads of the war on manpower and the need for conserving rubber and gasoline have slowed this service.

Since fuse replacement is a simple function, quickly learned by customers in a few minutes, the company has set up a board like the one shown in each of its twelve divisions sales offices. Through visual education and demonstration customers are being shown how they can relieve the burden on the company and restore their own service quickly by replacing their own fuses.

The board itself is simple. On its 3x5-ft. surface are mounted line side fuse block, meter, load side fuse block and two circuits, each with lamp, switch and convenience outlet. On this board the demonstration can show the effect of putting a penny behind the fuse, using frayed appliance cords and broken plugs.

There are many similar boards in use across the country, but experience with this one indicates that it is as complete and effective as most.

•

Organizing a Nutrition Program*

By J. H. KEELE
Residential Sales Manager
Florida Power & Light Company

Three distinct problems face the electric utility in undertaking a nutrition program. They are, first, finding a prepared, sustained program that is acceptable to the general public; second, organizing and conducting a program with reduced personnel, and third, getting results without incurring excessive expense.

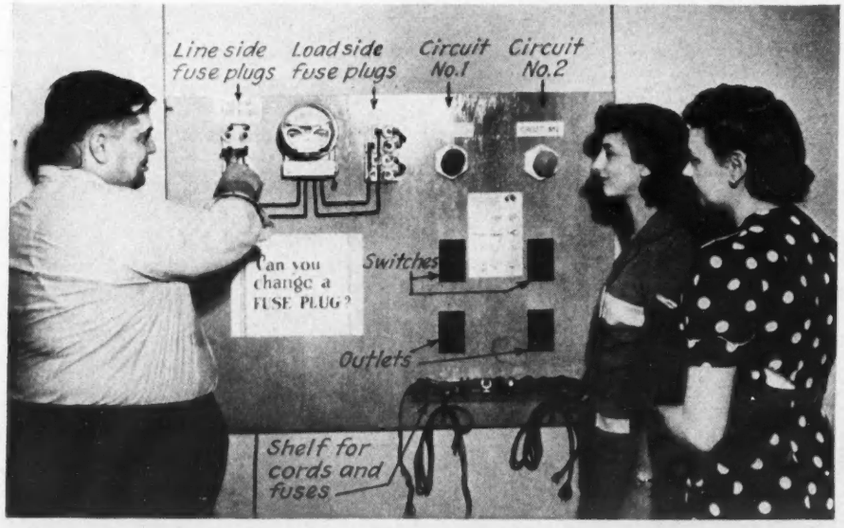
Florida Power & Light Company reviewed several such programs and designed a few, but none of them seemed exactly to fit our needs for the following reasons:

They were designed for large industrial war plants. The information they supplied was too technical. They furnished handout material only and only enough for one or two meetings. Stage props were not furnished. Materials were too costly for distribution.

Several months ago representatives of the Westinghouse Electric & Manufacturing Company presented to us their "Health for Victory" activity. We felt that this program, while primarily designed for use by industrial plants, would fit our needs if we were permitted to make certain changes so that it could be used for the general public.

Due to the fact that we had very few large industrial war plants, permission was granted, but then we found that the cost of conducting such a program far exceeded our budgeted expenses for this purpose. It then occurred to us that now was an opportune time to do some experimenting toward making the "Health for Victory" club activity self-sustaining.

In one district of our company we ordered all material necessary for organizing and conducting "Health for Victory" clubs. Before the program was introduced to any women's group it was first presented to the local defense council and was sanctioned by it as being a worth-while endeavor, especially when it found that it was a practical and informa-



DEMONSTRATION BOARD used on Iowa system teaches the customers how to replace their own fuses

*From paper to Southeastern Electric Exchange.

Dear Bill:

I just couldn't sit home any longer—waiting for your letters, worrying, but doing so little to bring you home sooner.

You see I started in this week at the war plant. They're training me to be a drill press operator. And you can just wipe that grin off your face, you big goof. The foreman says I'll make a darn good one!

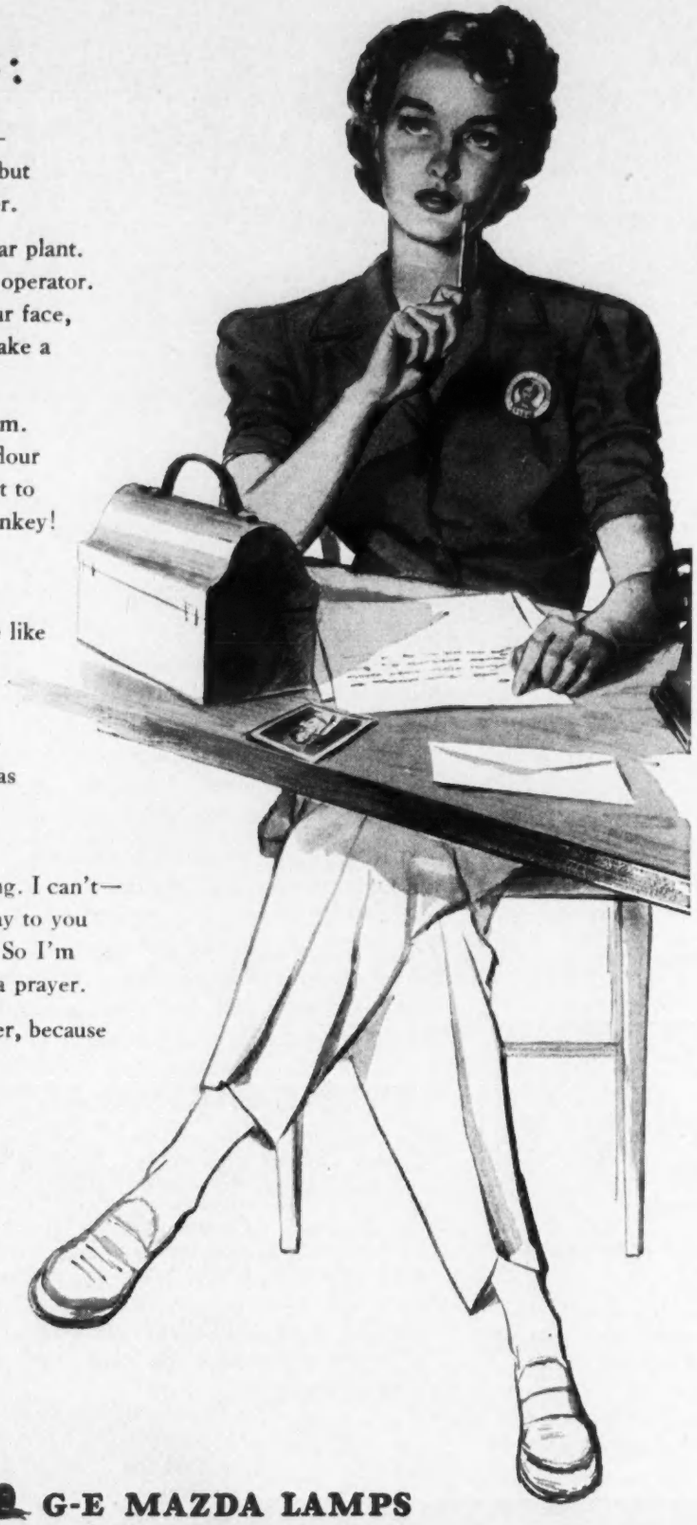
So here's a picture of me in my uniform. Remember how you used to wipe the flour smudges off my nose? Well, you ought to see me now—I'm a regular grease monkey!

I admit I was pretty scared the first day, until I got up nerve to really look the place over. I was afraid it would be like working in a dungeon—all dark and dingy!

But it's not like that at all. Why, the plant's as bright and cheery as our own kitchen. Even has that new fluorescent lighting!

I wish I could tell you what we're making. I can't—but I hope one of them may find its way to you someday—just when you need it most. So I'm sending my love with every one—and a prayer.

I'm not counting the minutes any longer, because I know you'll be back pretty soon.
So, darling . . . . . .
Oh, oh. There's the whistle now!

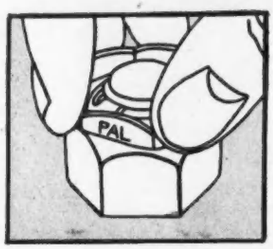


The lighting industry's biggest job today is to keep lighting at top efficiency twenty-four hours a day in the nation's war plants... G-E lighting engineers are ready to work with you to give war factories the better light they need for better production.

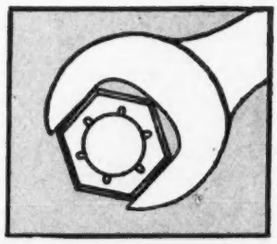
G-E MAZDA LAMPS

GENERAL ELECTRIC

EASY, SPEEDY APPLICATION



After regular nut is fully tightened, the PALNUT is quickly and easily spun on with the fingers until "finger-tight".



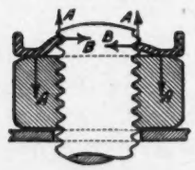
Then with standard wrench, linesmen's wrench or special PALNUT box wrench, give PALNUT an additional ⅓ turn to lock it. Effortless, one-hand operation. Easily removed and used again.

● Tighten a PALNUT Locknut once—and forget it! Neither severe vibration, shrinkage of parts nor bolt stretch can loosen its powerful double-locking action on both regular nut and bolt.

PALNUTS are single thread locknuts, made of tempered spring steel. They are widely used on steel transmission towers, wood pole lines, transformers, sub-station equipment, fittings, switches and other equipment. Requiring but 2 full bolt threads, PALNUTS may be used on existing as well as new assemblies. Perfect conductivity is assured on electrical connections. Although PALNUTS are going 100% into Army and Navy aircraft and other war equipment today, samples and data are available for testing or experimental work.

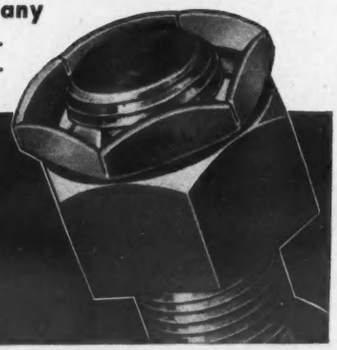
DOUBLE-LOCKING ACTION

When the PALNUT is wrench-tightened, its arched, slotted jaws grip the bolt like a chuck (B-B), while spring tension is exerted upward on the bolt thread and downward on the regular nut (A-A), securely locking both.



WRITE FOR PALNUT MANUAL NO 1
giving details of design, uses, sizes, etc.

The Palnut Company
51 Cordier St.
Irvington, N. J.



DOUBLE-LOCKING PALNUTS

tive sustained activity which did not pretend to qualify the club members as teachers of nutrition. Our representative in this district was successful in this trial endeavor by establising twelve clubs in a very short period of time.

While the regular "Health for Victory" program is offered on a twelve-month basis, we established clubs on a six-month basis, with a registration fee of 85 cents for each member. This fee was collected at the time the registrant joined the club and entitled the member to attend the six monthly sessions and to receive the six copies of the Westinghouse monthly meal planning guides in addition to a copy of our customer service book. Since the experiment in this one district of our company there have been formed about 20 more "Health for Victory" clubs in other districts on the same basis.

Activity Expanded

We originally intended to establish "Health for Victory" clubs in eight of the 32 districts of our company and use only half of the home service representatives' time for conducting them. The activity is now being expanded to include 18 districts and will require the full time of all home service representatives. We intend to continue our activities with women's organizations in addition to offering defense councils in the other 17 district towns the opportunity of sponsoring the "Health for Victory" clubs. They will also be given the opportunity to establish nutrition centers on our district office display floors.†

The estimated out-of-pocket expense for setting up and operating clubs totaling 5,000 members is:

5,000 Meal Planning Guides monthly at 10 cents each for six months	$3,000
10 sets of stage props and Meeting Guides monthly at $7.50 each for six months	450
5,000 Customer Service Books at 7 cents each	350
Incidental expenses such as food, membership cards, etc.	450
Total expenses	$4,250

This total out-of-pocket expense is offset by the revenue to be derived from 5,000 registered members at 85 cents for six months.

The good work we have done in the

[†EDITOR'S NOTE—A letter from Mr. Keele, dated December 7, 1942, giving information later than that contained in his paper, says "that a total of 62 clubs has been formed with a registered attendance in excess of 2,000 members. From all indications, we shall eventually establish 250 clubs with a combined membership of between 10,000 and 15,000.]

"...do it the *Electronic Way!*"

BETTER . . . FASTER . . . MORE ECONOMICALLY

Every day, throughout industry, RCA Tubes in modern Electronic equipment are helping replace both mechanical and human operations on a wide variety of tasks. Every day, they are making possible new standards of accuracy, efficiency, and economy—higher than are practical or feasible by any other method.

So far-reaching has been this industrial development of the Vacuum Tube, it is now the rare industry which does not already utilize various Electronic methods—or, by the same token, stand to benefit by the adoption of many more.

"Do it the Electronic Way" is far more than a slogan. It is a direct challenge to every business that has exacting work to be done still more exactingly.

The Electronic Way has few or no mechanical limitations, is often more economical, and provides freedom from the annoying element of human error!

As the acknowledged leader in the pioneering of Tubes for Radio, it is only natural that RCA should also lead the way in the design of Tubes for industrial uses. A wide variety of types, each with a background of proved dependability, affords a broad engineering selection. Write for Power and Special Tube Folder TT-100, or Phototube Folder PT-20RI to Commercial Engineering Section, RCA Manufacturing Co., Inc., 5th Street, Harrison, N. J.

RCA *Tubes* FOR INDUSTRIAL EFFICIENCY

Low Power • Medium Power • High Power • Cathode Ray • Phototubes
Thyratrons • Voltage Amplifiers • Rectifiers, etc.

HERE'S REAL NEWS!

New Guth Non-Metallic Reflectors Deliver More Light Than Porcelain Enamel!

4 Efficient Designs, for Every War Production Need!

GUTH Fluorescent is now made with Non-Metallic Reflectors to conserve vital materials for war industries. Yet this conversion has in no way necessitated any sacrifice in lighting efficiency! In fact the durable "300° White" synthetic Baked-Enamel, plus the engineered design, actually produces greater light output than do Porcelain Enameled Steel Reflectors! Get this quality lighting—now available in non-metallic units!

Original MAZE-LITE for 2-40, 3-40 to 2-100 watt with 77° light cutoff
SUPER MAZE-LITE for 4-40 and 4-100 watt lamps. Powerful lighting units for high intensities and high bays
Where lamp-shielding is required EGGCRATE MAZE-LITE fills-the-bill. Eggcrates like reflector are of non-metallic materials
FLUOFLECTOR units for 1 and 2 rows of lamps. For inspection lighting and over benches

Write Today For Newest Literature

Leaders in Lighting Since 1902 — Guth

THE EDWIN F. GUTH CO. • 2615 Washington Ave. • St. Louis, Mo.

past is now beginning to prove exceedingly valuable as clubs are easily being formed, and in some instances women's organizations are now applying to us for this assistance. As far as we know now, if the "Health for Victory" Clubs which are now established, or those that might be established in the future, wish to continue after the six-month period, they may do so on the same basis as they were originally formed.

•

Advertise Appeal to Insulator Marksmen

Thoughtless destruction of line insulators, an expensive nuisance in peacetime, takes on the complexion of unintentional sabotage in wartime. To combat this un-funny pastime by the junior element of the rock-throwing, sling-shot and rifle-toting public, Wisconsin Public Service Corporation has prepared an appeal, through advertising, to the fathers of the younger generation who may not realize the consequences of their acts.

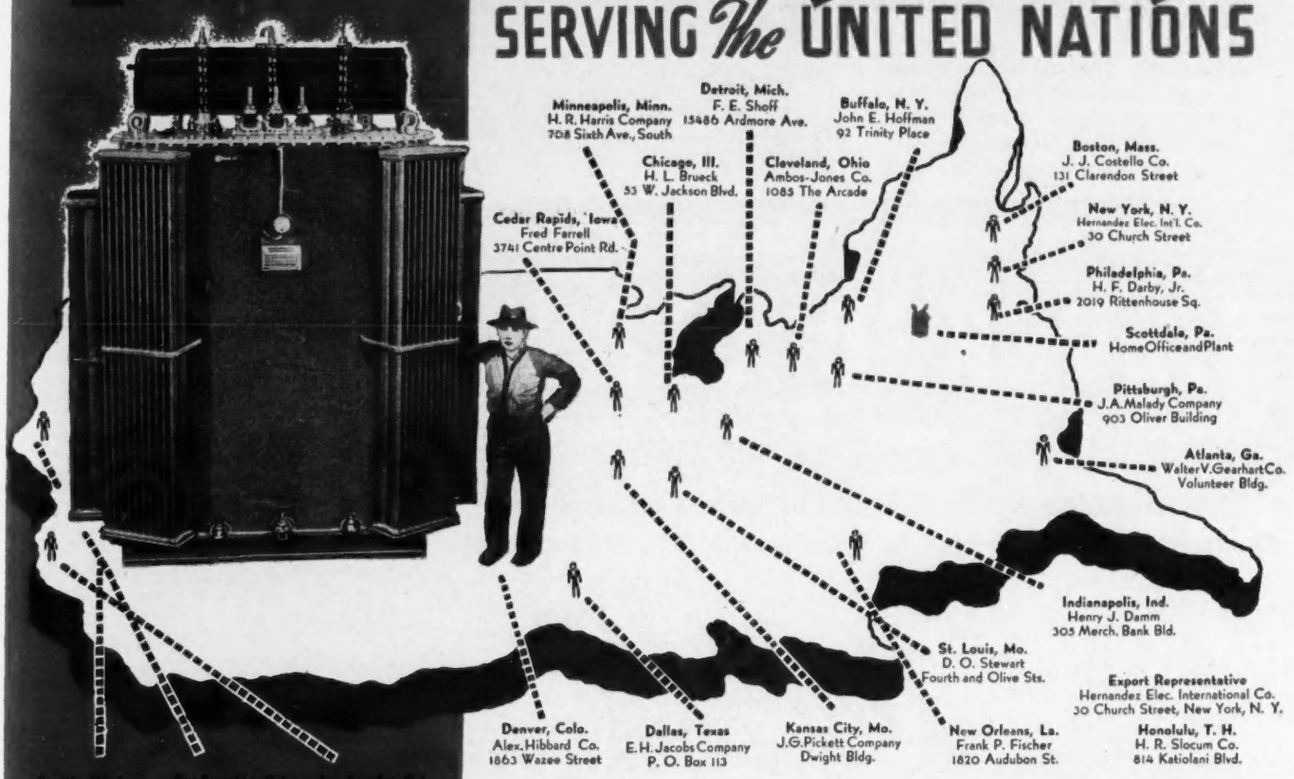
Thoughtless
SABOTEUR
"How about it, Dad?"
That insulator one of the boys "popped" with his rifle (or perhaps it was a slingshot or a stone) was pretty serious business.
It interrupted service to you and some of your neighbors. It might have stopped it at a moment when the failure caused serious damage, perhaps death itself.
It burned up truck gasoline and rubber.
It wasted the time of the line crew who had to repair the damage.
It wasted the effort of a china or tempered glass insulator factory which should be eternally busy on war orders. It wasted the space and the fuel it took a railway to haul the replacement material here.
It just wasn't good citizenship. We hope that it wasn't fun, for only very quiet people would think it funny.
WISCONSIN
Public Service
CORPORATION

WISCONSIN UTILITY drafts appeal to thoughtless insulator saboteurs

In the accompanying sample advertisement, to be carried in local papers where such trouble has been encountered, the company points out that insulators that have been "popped"

for 1943 Uptegraff TRANSFORMERS

SERVING *the* UNITED NATIONS



An Uptegraff designed and built Transformer is assurance of Satisfaction

Meeting the call for Transformers for the war needs of our country, and for our allies and our own military in far-off places of the world—that is the 1943 task for the Uptegraff organization.

Designing and building Transformers only, you expect, and always find, Uptegraff quality and service that is unsurpassed.

Tell us your transformer requirements.

R. E. UPTEGRAFF Manufacturing CO.

SCOTTDALE, PENNA., U.S.A.

Bin LIGHTING

For full illumination of Parts Bins, Tool Crib Bins and Shelves, Stockroom Shelves, Carton Stacks, File Rooms, Library Stacks — wherever you need "quick, accurate seeing" from top to bottom, install PERMAFLECTORS, the silvered-glass reflectors especially designed for this purpose. Easily, quickly, inexpensively installed. Get prompt delivery . . . No priority on GLASS!

HIGH-EFFICIENCY PERMAFLECTORS of SILVERED GLASS

Conserve Critical War Materials
Assure Prompt Delivery!

Decrease Spoilage — Reduce Accidents — Speed Production

Light Up THE WEAK SPOTS IN YOUR PLANT!

Need MORE light, BETTER light here and there in your production line? ✪ Put in Permaflector "Auxiliaries" — the high-efficiency, silvered-glass reflectors that put the light where you need it, as you want it! ✪ A size and shape for any desired distribution. ✪ Easily, quickly, inexpensively installed without affecting work flow. ✪ Use Minimum Critical War Materials! ✪ Specify Permaflectors! ✪ A Pittsburgh lighting engineer will be glad to go over your plant without obligation!

PITTSBURGH REFLECTOR CO.

Pittsburgh Permaflector

406 OLIVER BLDG. • PITTSBURGH, PA.

Tear Off

Clip to letterhead. Sign. Mail for complete information, prices.

with Johnny's new rifle can mean interrupted service to neighbors, burned-up gasoline and rubber and wasted time for a busy line crew. Such damage in wartime wastes the effort of insulator factories and needlessly consumes space and fuel of railroads to haul replacement materials.

Through its appeal to reason and patriotism the advertisement is a friendly request for cooperation that goes much farther toward solving a trying problem than police patrols, warrants and the like, with their attendant ill-will.

•

A Report

A WAR INDUSTRY
Makes Its Report

THE Army-Navy "E" for Excellence is not yet available to power companies to tell you whether we are doing our war job as well as we should. But you have a very serious interest in knowing how we are measuring up. In his recent message to Congress, President Roosevelt said: "*Speed and volume of war output have become more than ever in our history the primary conditions of victory.*"

Without electric power, "speed and volume" would be hard to get. War output would slow down. Our country might not meet the "conditions of victory." The war has given really vital importance to the job of producing and supplying electric power. Here is our report:—

NO SCARCITY—There are scarcities of almost everything, except electricity. We have supplied 190,000,000 more kilowatt hours this year than in the same period of last year. Even during the record-breaking 1941 drought, when some curtailment of electricity for civilian uses was necessary, there was no curtailment of power for war production.

NO PRICE INCREASE—Practically everything has gone up in price, except electricity. Our expenses have gone up, just like everybody else's, but our prices have not.

EXTRA MANPOWER—Electricity multiplies one man's strength ten, a hundred, a thousand times. Whether it is pumping water on the farms or operating giant cranes in ship yards, electricity's job is to take work off the backs of humans. It can and will help relieve the shortages of manpower. And it can help in a BIG way! Just one of our generating stations turns out energy that equals the strength of SIX MILLION MEN — more than our Army and Navy.

INCREASED SUPPLY—Since June, 1941, we have added 220,000 horsepower of new generating capacity. An additional 60,000-horsepower unit is nearing completion. All of the increase is in steam-operated stations, thereby giving added protection against droughts.

SALVAGING AND SAVING—Thousands of pounds of scrap have been turned in and our uses of scarce materials have been sharply cut. A new transmission line to the Brunswick ship yards, just completed, was built on wooden poles instead of steel towers. And new copper wire was not used. Our engineers figured out a way to use wires taken from other Company lines. Government authorities have agreed the news of this far and wide, as an example of how copper and steel can be saved.

ON THE HOME FRONT—666 of our employees are already with the armed forces. Many of the rest of us are helping in Civilian Defense. Several are on loan to the government agencies. And we are fighting with our dollars—buying bonds, paying higher taxes.

These are some of the principal items in our Report to the Public. In every other way we can think of, we are trying to back up the fighters, at the front and in the fields and factories, to help win the war.

HERE is something to remember the next time you pay your electric bill. In August, 1939, when the war began in Europe, our residential electric customers were paying an average of 2.88 cents a kilowatt hour —one of the nation's lowest. Since then our average price has gone DOWN to 2.72 cents—a drop of more than 5 percent! But the price would be 3.41 cents today, if our prices had gone UP like other prices, for the cost of living has gone UP 19 percent. So, if electricity prices had followed other prices upward, they would now be about *25 percent HIGHER!*

GEORGIA POWER COMPANY
A War Industry

This Georgia Power Company newspaper advertisement tells its own story even though the necessary reduction to reproduce it here makes the body type difficult or perhaps impossible to read. The meat of it is contained in the quoted words of a brigadier-general of the U. S. Army which appear in a companion advertisement of the same company: "It's a matter of record that the performance of the electrical industry in America's war effort thus far has been unsurpassed. This industry has been faced with colossal problems caused by the need for swift expansion of factories. Its response has been truly magnificent."

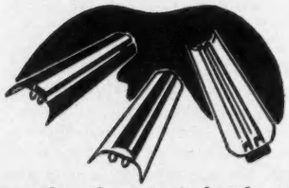
A LIGHTING FIXTURE HAS A BIG RESPONSIBILITY IN A WAR PLANT

Here are the Answers..

to questions that contractors, wholesalers, engineers, chief electricians, maintenance and purchasing departments are asking about Fluorescent Lighting fixtures

1. How can I be sure of getting dependable lighting fixtures?

By specifying fixtures that have been tested and certified for electrical, mechanical and lighting efficiency by independent experts. Certified FLEUR-O-LIER fixtures meet 50 definite standards set up by MAZDA lamp manufacturers to assure dependable performance. They are tested and *Certified* to those standards by Electrical Testing Laboratories, Inc., of New York.



2. Who makes these tested and certified fixtures?

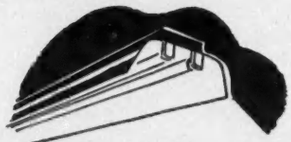
Certified FLEUR-O-LIERS are made by over 40 leading fixture manufacturers. Any fixture manufacturer who complies with the FLEUR-O-LIER requirements may participate in the program.

3. What are some of the points checked by this testing?

Some of the most important specifications checked by Electrical Testing Laboratories are: High power factor, flicker correction, certified ballasts and starters, brightness control, safety, maximum light output, correct heat dissipation and many others.

4. Don't other makes of fixtures have these features?

Perhaps. But you can be sure of them *all* in Certified FLEUR-O-LIERS. And because they are Certified by E.T.L., any further test or check by the user is unnecessary.



5. Do FLEUR-O-LIER fixtures have non-metallic reflectors?

Many FLEUR-O-LIER Manufacturers now make Certified fixtures using non-metallic reflectors, conforming to WPB order L-78 (Amended) and U.S. Bureau of Standards Specifications. FLEUR-O-LIER specifications also cover these units.

6. How can I tell FLEUR-O-LIERS from other fixtures?

FLEUR-O-LIERS are easily recognizable by the Certification label shown on every fixture. Make sure this label is on the fixtures you specify to assure dependable lighting performance and operation.

7. Are FLEUR-O-LIERS now available—and on what basis?

They are now available on a suitable priority to war plants. Ask your supplier or, for a complete list of manufacturers, write FLEUR-O-LIER Manufacturers, 2126-1 Keith Building, Cleveland, Ohio.

NEW! Booklet giving complete FLEUR-O-LIER manufacturing specifications. All technical information for architects, contractors, wholesalers, engineers and purchasing departments on electrical, mechanical and lighting standards as set up for CERTIFIED FLEUR-O-LIER fixtures. Write NOW to FLEUR-O-LIER Manufacturers, 2126-1 Keith Building, Cleveland, Ohio.

FLEUR-O-LIERS

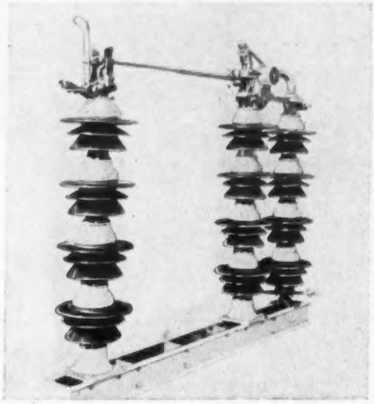
CERTIFIED FIXTURES FOR FLUORESCENT LIGHTING

Participation in the FLEUR-O-LIER MANUFACTURERS' program is open to any manufacturer who complies with FLEUR-O-LIER requirements

NEW EQUIPMENT

Disconnecting Switch

Group-operated disconnecting switch is equipped with full-floating, self-wiping, self-aligning contacts. A special hinge in the jaw contact assembly is said to eliminate any bending stress from being transmitted to the insulator stacks. Compression springs are protected from sleet and operating arms provide full ice-breaking leverages, it is claimed.

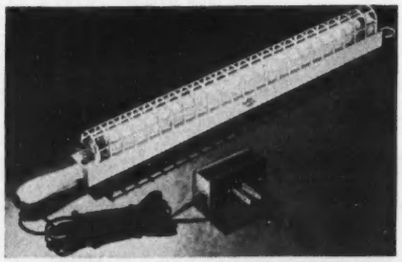


Type "CH" three-insulator, vertical-break, high-pressure, group-operated disconnecting switch; available in voltage ratings of 15—161 kv. and 400—600 amp. **Southern States Equipment Corp.**, Birmingham, Ala.

•

Portable Lamp

Useful in small, narrow spaces, new portable lamp of heavy-gauge steel may be laid on any of three sides, can be held from its wooden handle or can be suspended by a steel hook at opposite end. Light rays are directed away from the worker's eyes.



"Extensolite," mechanic's fluorescent lamp; two sizes, 6 or 15 watts, wired for 110-125 volts, 60 cycles; has 10-ft. cord, is finished in white enamel. **Edwin F. Guth Co.**, 2615 Washington Ave., St. Louis, Mo.

•

Blue Print Machine

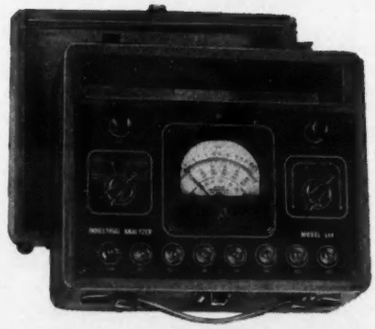
Portable machine for making blueprints or black and white prints, connects to any convenient outlet, operates on alternating or direct current, 110-120 volts, consumes 1,200 watts. **Victoray Corp., Battle Creek,** Michigan.

Blueprint machine is said to produce prints in less than three minutes. Time control turns lights off automatically, prevents over or under exposure of prints, it is claimed. The device, which can be operated in daylight, makes 24 x 34-in. prints on a 24 x 36-in. sheet, or several smaller prints in one operation.

•

Analyzer

Portable industrial analyzer is a self-contained unit and operates on 1½-volt dry cell. Same voltage scale is used for both a.c. and d.c. voltage measurements. Separate tip jacks for each individual range is said to minimize possibility of meter damage by overloading and burning out.

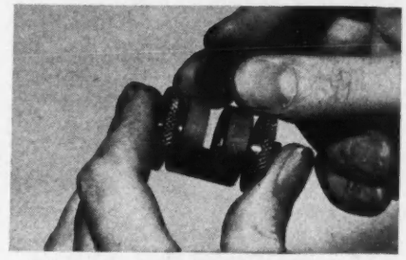


"Model 560" industrial analyzer; measures a.c. and d.c. voltages in five ranges 0—6 to 0—1,500 volts, resistances 0—250 to 0—2,500 ohms, a.c. current up to 30 amp., which may be extended by use of external transformer. **Superior Instruments Co.**, 227 Fulton St., New York, N. Y.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Cutout By-pass

Circuit-testing device for Novalux loop-sectionalizing cutouts has been developed to enable the service man to determine whether the circuit is actually closed before installing a new by-pass. This device is not intended as a substitute for the Thyrite by-pass. It is unable to differentiate between a surge voltage such as that caused by lightning or a sustained overvoltage caused by an open circuit.



Testing by-pass equipped with an SL-type film cutout for testing street-light circuits. **General Electric Co.**, Schenectady, N. Y.

•

Transfer Switch

"Automatic Transfer Switch," furnished in 1, 2, 3 and 4 pole types and 18 capacities from 30 to 600 amp.; mounted on ebony asbestos panel. **Zenith Electric Co.**, 152 W. Walton St., Chicago, Ill.

For use in buildings where a continuous source of supply to lighting circuits is necessary, transfer switch is so constructed that, on failure of the normal service, the load is automatically transferred to an emergency service and on resumption of normal supply the load is returned to this source. The larger capacity switches are constructed with two individual magnetic contactors, mechanically interlocked. Transfer from either source is through a normally closed relay, connected to the normal supply source. All transfers are automatic and, it is claimed, require only 1/25th second for the operation.

•

Correction

The announcement on the Radio City cathode-ray oscilloscope, described on page 86 of the January 9 issue of ELECTRICAL WORLD, should have read as follows:

Designed to meet requirements for extended frequency measurements, new cath-

A CENTURY OF SERVICE

When, at midnight on December 31st the clock chimed twelve, and we passed into the year 1943, then did Hubbard and Company enter its second century in business. We think it is excusable to believe that such survival and notable growth could only be possible for an institution built on solid foundations with a steadfast policy of honest service in all its ten decades of existence.

That past generations of "Hubbard" men have done a splendid job is attested by the Present. We owe all to their courage, devotion and inspiration. We of the Present cannot rest on their laurels. We must turn our eyes to the Future.

On this, the advent of our "century in business," we thank you, our friends, for your ever loyal support and pledge that we of the Present "Hubbard" generation will keep faith with our predecessors of the past 100 years.

May our wishes for your Peace and Happiness bear fruit in 1943. Sincerely and Gratefully,

HUBBARD & COMPANY

HARPER
STOCKS
the UNUSUAL
AND MAKES THE
"Super Unusual"
Think of 4320 stock items of fastenings . . . including almost every conceivable type of bolt, nut, screw, washer and rivet in the non-ferrous and stainless alloys. Such a stock is one of Harper's contributions to a nation at war.
If the fastening you want isn't in this stock, Harper can make it promptly (priorities permitting) on extensive, modern, high speed machinery . . . from stocks of metals in basic forms. Submit your specifications.
BRASS
BRONZE
COPPER
EVERDUR
MONEL
STAINLESS
WRITE FOR CATALOG
. . . and reference book. 80 pages—4 colors—193 illustrations — numerous tables and other data. Free when requested on company letterheads.
The H. M. HARPER COMPANY
2611 Fletcher Street • Chicago
45 West Broadway • New York City
Offices in Principal Cities
ARMY E NAVY
Awarded Dec. 7, 1942
HARPER Chicago
EVERLASTING FASTENINGS

ode-ray oscilloscope operates from standard 115-230-volt, 50-60-cycle alternating current power supply. Maximum d.c. voltage at input terminals of amplifier is 600 volts and direct to deflection plates 500 volts, rms. Input resistance is 3 megohms. Voltage gain is approximately 275 times and ultra-wide frequency range of sweep signal generator from 30 cycles to 350 kilocycles, linear from 50 cycles.

TECHNICAL LITERATURE

UTILIZATION VOLTAGE STANDARD RECOMMENDATIONS—Joint E.E.I. Committee Report (Publication J8) recommends spreads and limits alike for guides to design of (1) utilization equipment and (2) distribution systems; 12 pages. Price to U.S.A. nonmembers $0.50. Edison Electric Institute, 420 Lexington Ave., New York, N. Y.

INSULATOR STANDARDS—Tables of characteristics for pin type, suspension, and switch and bus insulators, also a procedure for checking ratings and tolerances of insulators, are included in "High Voltage Insulator Standards," publication No. 42-83, price $1.00, available from National Electrical Manufacturers Association, 155 East 44th St., New York, N. Y.

DRIVE CONTROL—Charts and diagrams explain how Rototrol, a d-c adjustable speed drive control, regulates by transposing mechanical and electrical quantities. Typical applications of the control are described and illustrated in booklet B-3123, "A Challenge to Designers of Drive Control," which may be obtained from Dept. 7-N-20, Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

STANDARDS—Following standards are Approval Specifications under Part II of the Canadian Electrical Code: C22.2 No. 3-1942—Electrical Equipment for Oil-Burning Apparatus, price 50 cents; No. 46-1942—Electric Air-heaters, price 50 cents; No. 61-1942—Electric Ranges, price 50 cents; No. 64-1942—Cooking and Liquid-heating Appliances (Domestic and Commercial Types), price 75 cents; No. 72-1942—Heating and Heater Elements—Replacement Types, price 50 cents; No. 77-1942—Inherent Overheating Protective Devices for Motors, price 50 cents. All may be obtained from the Canadian Engineering Standards Association, National Research Building, Ottawa, Ontario.

RECTIFIERS—Conversion-equipment problems in the steel industry and applications of ignition mercury-arc rectifiers, also comparative efficiencies of three types of power-conversion units, effect of phase control on output-voltage and output-current wave shapes, are some of the items covered in Bulletin GEA-3827, "Ignitron Mercury-arc Rectifiers in the Steel Industry" issued by General Electric Co., Schenectady, N. Y.

MOTORS—Squirrel-cage motors of various types and in sizes ½ to 75 hp. may be selected in three steps by the use of a "Motor Finder," a slide rule obtainable from Allis-Chalmers Mfg. Co., Milwaukee, Wis.

LIGHTING — "Incandescent - Fluorescent Maintenance Manual" provides suggestions on how to obtain the best and longest possible service of lamps and lighting installations. The 24-page booklet is obtainable from Champion Lamp Works, Div., Consolidated Electric Lamp Co., Lynn, Mass.

AMER TRAN

AmerTran power transformers available for all requirements in sizes to 10,000 KVA, 132 KV.

AmerTran distribution transformers of either oil- or noninflammable-liquid-immersed type available in sizes to 500 KVA, 72 KV.

AmerTran air-cooled transformers for either indoor or outdoor service are available for all industrial requirements—sizes to 150 KVA.

SOME day when we have fulfilled our Government obligations, we will be in a position to tell you fully the amazing story of the improvements that are being made in AmerTran products—today.

Today, wherever the new AmerTran products are being installed in connection with the war effort, electrical men are realizing that AmerTran is producing transformers that are *new*—new in electrical design, new in mechanical features, new in efficiency and economy.

True, we have placed entirely at the disposal of the Government and customers with high priorities our new and greater plant capacity. But, as for the past 41 years, we are still glad to extend to you, without obligation, the advice of AmerTran Engineers to help you secure the best results from your present equipment, to help solve today's problems of operation and maintenance, and to plan for your future needs in transformers for all utility and industrial applications.

AMERICAN TRANSFORMER COMPANY, 178 Emmet St., Newark, N. J.

Manufactured Since 1901 at Newark, N. J.

AMERTRAN

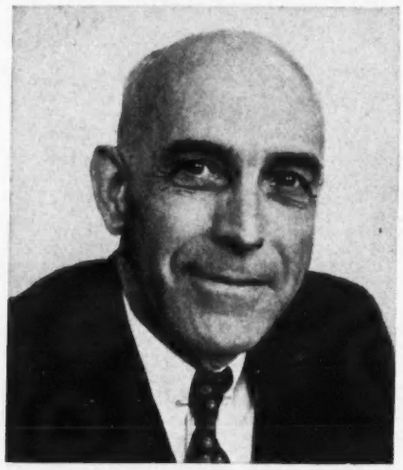
AmerTran transformers are manufactured to meet your exact electrical and mechanical requirements

NEWS ABOUT PEOPLE

S. G. Reque of Allentown Receives Promotion

S. G. Reque, who for some years has served as design engineer of the Pennsylvania Power & Light Co., Allentown, has been appointed chief engineer, succeeding the late Nicholas Stahl.

Mr. Reque is a graduate of the Uni-



versity of Minnesota, with the degree of E.E. His early professional activities were in the Middle West as an independent consulting and construction engineer. In 1910 he transferred his interests to the East to take a position with the New York Edison Co. during the modernization of its Waterside No. 1 station. In 1912 he accepted a position with one of the predecessor companies of Pennsylvania Power & Light Co. and has acted in engineering capacities with this organization to the present time.

•

► WILLIAM W. EDSON, station-electrical design division head, Boston Edison Co., has been elected chairman of the Electrical Equipment Committee of New England, a group of engineers meeting informally from time to time to discuss problems in utility and other fields involving advanced methods of electrical operation and application. The new vice-chairman is Fred A. Hubbard, electrical engineer New Bedford (Mass.) Gas & Edison Light Co. Ralph D. Harrington, Electric Storage Battery Co., Boston, was re-elected secretary.

► ALTON T. LITTLEFIELD, commercial manager Central Maine Power Co., Augusta, Me., has been appointed state chairman of the Maine War Bond Staff, Augusta, succeeding the late Walter S. Wyman. Mr. Littlefield has been acting as vice-chairman for the past few months.

•

Puget Sound Power Announces Promotions

George E. Quinan, formerly chief engineer, has been advanced to chief consulting engineer of the Puget Sound Power & Light Co., Seattle, Wash. In that capacity he will be responsible for all engineering activities of the company. Magnus T. Crawford has been appointed chief engineer of the company, in charge of the work of the general engineering department. This plan will relieve the consulting engineer of the additional load of responsibilities which have been brought about by the war program.

Mr. Quinan has been connected with the Puget Sound system since 1904, when he started with the Columbia Improvement Co. on the construction of the Electron hydro-electric development. He held numerous positions of responsibility with the Puget Sound company before his appointment as chief engineer.

Mr. Crawford started his engineering work with the Snoqualmie Falls Power Co. in 1906 and later became connected with the Puget Sound Power & Light Co. He was made assistant chief engineer in 1936 and has continued in that capacity until his present promotion to chief engineer.

Oklahoma Group Elects J. C. Happenny President

J. C. Happenny, president of the Oklahoma Power & Water Co., Sand Springs, Okla., was recently elected president of the Oklahoma Utilities Association for 1943.

Mr. Happenny entered the public utility industry in 1929 when he was appointed assistant to the treasurer of Central and South West Utilities Co. at Dallas, Tex. Two years later he was made secretary of the company. In 1933 he became treasurer of the Central Illinois Public Service Co., Springfield. It was in the summer of 1939 that he assumed the duties of president of the Oklahoma Power & Water Co. with offices in Sand Springs.

Born in Waltham, Mass., Mr. Hap-

penny received his education at Lowell Institute, Boston, and at the University of Illinois. Before entering the utility field he was connected with the U. S. Gypsum Co. for four years, engaging in sales work in Pennsylvania, Illinois and Texas.

At the present time Mr. Happenny is president of the Sand Springs Chamber of Commerce, and Commander, U. S. Citizens Defense Corps, Tulsa County.

"What Material . . . Now?"

If you have run the gamut of "substitute" materials . . . only to have the substitute become scarce, too . . . Continental-Diamond can help you.

C-D has five basic types of NON-metallics . . . three that are especially suited to meet structural design requirements.

Each one of these three basic non-metallics has applications for which it is individually fitted. C-D will cooperate with you . . . to help determine whether you can effectively use a C-D non-metallic . . . now.

An important point is that C-D NON-metallics are not substitutes . . . in fact, they have been used for many years and have valuable characteristics of their own . . . and in many applications do a more effective job than the materials replaced.

In several instances, C-D engineering has brought about outstanding improvements in product performance . . . economies in production . . . broken "bottlenecks" . . . by studying the problems, then recommending the proper C-D NON-metallic for the specific job.

C-D's position is most unusual . . . C-D's NON-metallics are varied . . . C-D in its 46 years of helping industry to properly use NON-metallics has accumulated a wealth of "NON-METALLIC KNOW HOW."

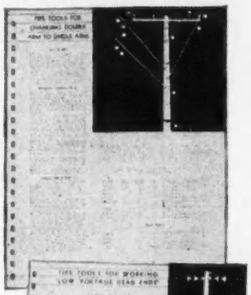
Let's work together NOW on your "What Material" problem . . . a good start is to ask for Booklet GF-12.

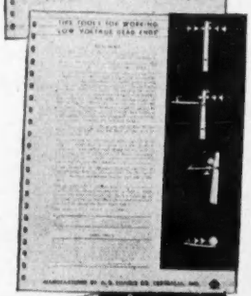
Continental-Diamond FIBRE COMPANY

Established 1895 . . Manufacturers of Laminated Plastics since 1911 — NEWARK • DELAWARE

There's no time like RIGHT NOW...

... to see that hot line crews are equipped to handle any emergency





With the axis powers finally on the defensive there can be no let up in the continuous flow of power, the ammunition of industry. Even the slightest delay may add many days to the struggle. This we do not want and can prevent. Line repairs must not, need not, create bottlenecks. Repair crews properly equipped with Tips Hot Line tools and a thorough knowledge of their use can handle practically any emergency repair job without interrupting service.

If your crews are not already equipped to make insulator, cross arm, or complete pole changes while lines are energized there is no time like right now to get this job done.

Tips Tool Demonstrators like the one shown above may be long delayed in getting around to see you. Army camps and Ordnance plants keep them pretty busy but your Tips Tool Catalog is complete with diagrams and descriptions which show how to handle every known type of live line maintenance work. In it you can see for yourself that hot line work is reduced to its simplest, safest form when crews are equipped with Tips Tools. Confer with your maintenance men and order complete equipment today.

Tips Tools are still available at no price increase.

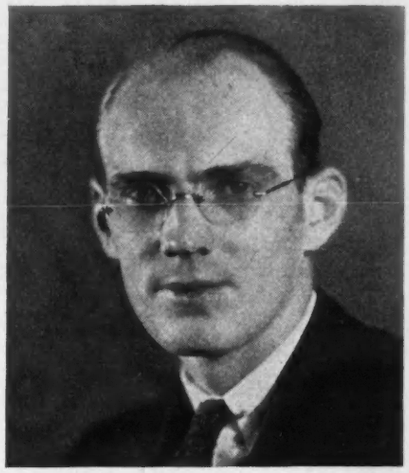
CONSULT THIS BOOK

A·B·CHANCE CO.
CENTRALIA, MISSOURI.

Raymond Made Manager Lighting Sales

Ralph G. Raymond has been appointed manager of lighting sales of the Commonwealth Edison Co. and president of the Chicago Lighting Institute, succeeding Oliver Hogue, who has retired after 46 years in the electrical industry.

Mr. Raymond, formerly assistant manager of lighting sales, became illuminating engineer, Electric Association of Chicago, in 1926, following graduation from Lewis Institute. When the Chicago Lighting Institute was built in



1929 he was engaged as managing director, serving in that capacity for nine years. In 1938 he joined Commonwealth Edison as supervisor, sales promotion, lighting sales department. Three years later he was appointed assistant manager, lighting sales.

•

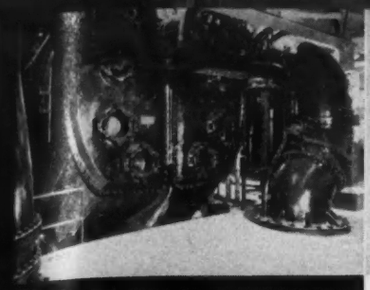
▶ FRANK W. CLARK has been appointed a member of the California Railroad Commission by Gov. C. L. Olson. Mr. Clark as been state director of public works throughout the Olson administration.

▶ LEONARD T. BLAISDELL, General Electric commercial vice-president at Cleveland, Ohio, was awarded the honorary degree of electrical engineer at the winter graduation of the Case School of Applied Science in recognition of his "long and distinguished professional record." Mr. Blaisdell has been manager since 1939 of General Electric activities for the states of the East Central district. He was manager for 15 years of the Southwestern district of Dallas. He is a fellow and a former vice-president of the American Institute of Electrical Engineers.

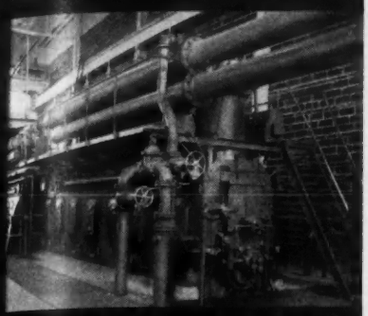
▶ MERLE TURNER, district manager of the Iowa Southern Utilities Co. at Corydon for the past four years, has

WORTHINGTON

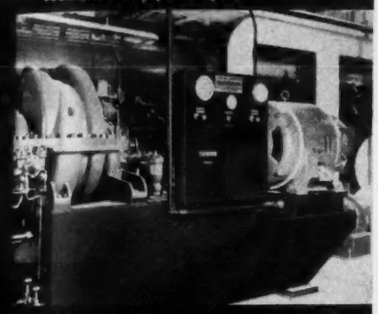
EQUIPMENT FOR UTILITY POWER



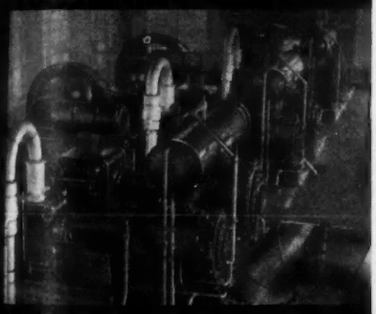
0,000 sq. ft. two-pass surface condenser



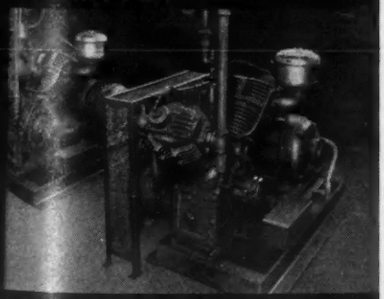
500-horsepower vertical gas engine in a southern utility power plant



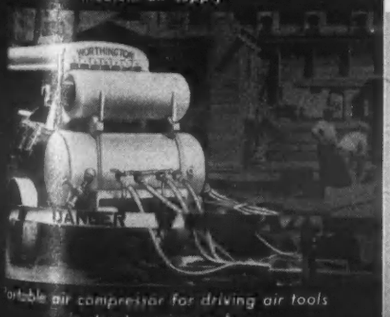
ugal refrigerating compressor, water cooler, water-cooled condenser combined



Three large steam driven compressors on manufactured gas distribution



Angle-type compressors for small and medium air supply



Portable air compressor for driving air tools in street service work

★

STEAM TURBO-GENERATOR UNITS
All types up to 7500 kw.

MULTI-STAGE STEAM TURBINES
All types 25 hp. to 10,000 hp.

SINGLE-STAGE STEAM TURBINES
Up to 2500 hp.

COMBINED STEAM TURBINE AND REDUCING GEAR UNITS
5 hp. to 200 hp.

REDUCING AND INCREASING GEARS

DIESEL ENGINES
150 hp. to 1500 hp.

GAS ENGINES
175 hp. to 2880 hp.

CONVERTIBLE GAS-DIESEL ENGINES
150 hp. to 1500 hp.

STEAM CONDENSERS
Of all capacities, with all auxiliaries.

STEAM-JET EJECTORS
For moderate to high vacuum service.

CENTRIFUGAL BOILER FEED PUMPS
For medium and high-pressure service.

CENTRIFUGAL GENERAL SERVICE PUMPS
For every required application.

AIR AND GAS COMPRESSORS
For small, medium and large air supply. Steam, motor or engine driven.

FEEDWATER HEATERS AND DE-AERATORS
Open type, for individual requirements.

WATER PURIFICATION EQUIPMENT
Softeners and filters.

REFRIGERATING AND AIR CONDITIONING EQUIPMENT

TURBINE WELL PUMPS
For general, sump and other services.

STEAM, POWER AND ROTARY PUMPS
For boiler feed and varied services.

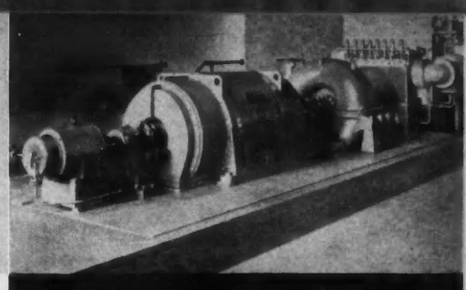
LIQUID METERS
All types; hot or cold water, chemicals, etc.

V-BELT DRIVES
Complete drives, sheaves or belts only.

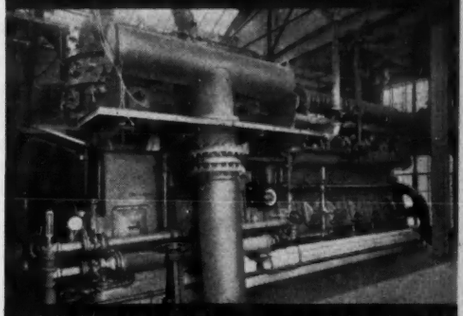
PORTABLE COMPRESSORS AND AIR TOOLS
For new construction and maintenance service.

★

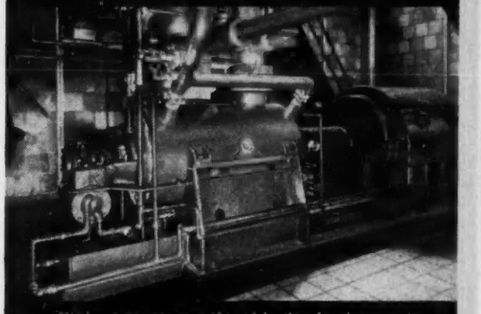
IC3-6



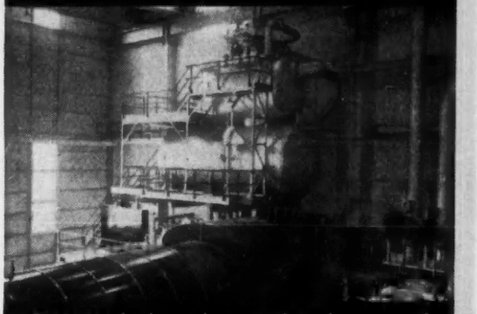
Condensing type steam turbo-generator unit



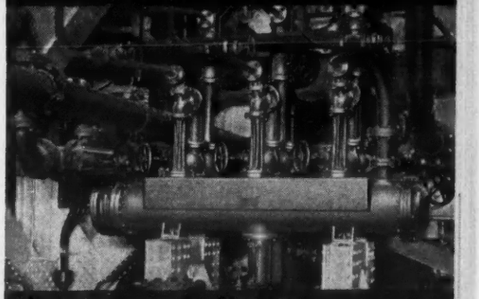
A Unibloc gas-engine compressor unit in utility gas distribution service



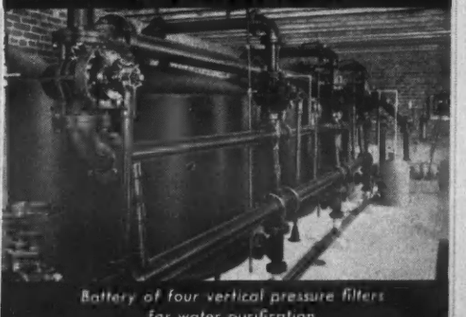
High-pressure centrifugal boiler feed pump in a large power plant



Stationary feedwater heater in the turbine room of a large public utility power plant



Steam-jet air ejectors for high vacuum service in power and process plants



Battery of four vertical pressure filters for water purification

A complete coverage for every important power plant function

WORTHINGTON PUMP AND MACHINERY CORPORATION

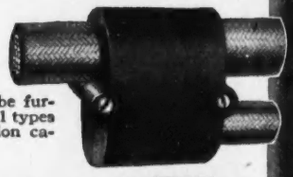
General Offices: **HARRISON, NEW JERSEY**

Offices and Representatives in Principal Cities

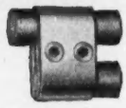
from the MOST COMPLETE lin
of Cable Taps

Now you can select from a really *complete* line of standard and special taps. Every one carefully designed and manufactured.

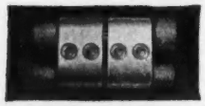
Parallel and 90° taps — and combinations — in the widest variety. For conductor sizes up to 1,000,000 CM.



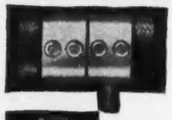
Gutter Tap with Bakelite Cover. Insulating covers can be furnished for all types of Penn-Union cable taps.



2-way Gutter Tap. Main and branch sizes 8 to 1,000,000.



Two Separate Parallel Taps to a continuous main conductor.



Combination Cable Taps; one branch parallel to main, and one at 90°.

Hinged Clamp of Penn-Union Type HFM makes installation easy. Multi-slit tapered sleeve assures permanent grip on branch.

Positive Equalized Pressure on main and branch, with Penn-Union Type SM. Tightening torque is accurate measure of the clamping force.

Also the *most complete line* of Service Connectors — Terminals — and thousands of other fittings, for all requirements.

PENN-UNION ELECTRIC CORPORATION
ERIE, PA. *Sold by Leading Jobbers*

PENN-UNION
Conductor Fittings

been transferred to Washington, Iowa, as district manager. He has been succeeded at Corydon by JAMES YOUNG of Centerville, Iowa.

▶ RICHARD C. CARR has been appointed head of the new war housing division of the Libbey-Owens-Ford Glass Co.

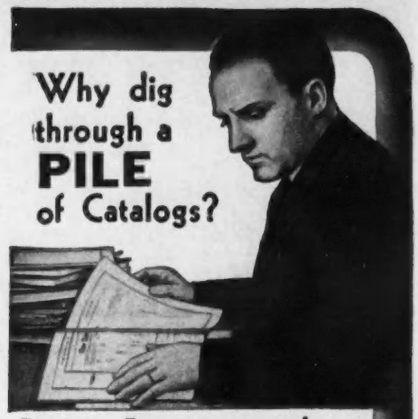
▶ JOHN G. PORTER has been placed in charge of all sales promotion activities of the transmitter and electronic tube divisions of the General Electric radio, television and electronics department, Schenectady, N. Y. Mr. Porter was formerly with the company's publicity department.

▶ FRANCIS E. MILLER, who has been connected with the Pacific Power & Light Co., at White Salmon, Wash., has been transferred to the company's Goldendale office as manager. He succeeds JOHN S. BAILEY, who has entered military service.

▶ J. L. SANDERS, who has been connected with the Sanford office of the Florida Power & Light Co. as commercial representative for six or seven years, has been transferred to the Fort Myers office, where he will become assistant to the manager.

▶ J. EDWIN DOYLE has been appointed assistant to the manager in charge of labor relations at General Electric Co.'s Lynn River works. Mr. Doyle has been with the company since 1916. He was granted a leave of absence by the company in 1939 to reorganize and administer the activities of the Massachusetts Unemployment Compensation Commission at the request of Governor Saltonstall. Prior to his new appointment Mr. Doyle was supervisor of the personal department of the company's Everett works.

▶ DAVID HALL, engineer connected with the Westinghouse Electric & Manufacturing Co. since 1908, has retired after spending 46 years in the electrical industry. Mr. Hall has headed engineering activities for Westinghouse in the Los Angeles area since 1926. He served as engineering supervisor until mid-1941, when he was named assistant to the Pacific Coast district engineering and service manager and assigned to special work. He was succeeded as engineering supervisor by E. W. MORRIS, also of Los Angeles. A graduate of Lehigh University, class of 1896, Mr. Hall entered the electrical industry the same year and joined Westinghouse at East Pittsburgh, Pa., eight years later. For many years he was active in the design and construction of direct-current equipment in the power engineering section at the company's East Pittsburgh headquarters plant. In 1926 he went to the Pacific Coast. He is a fellow of the American Institute of Elec-



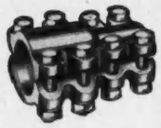
Find the Fitting you need—
quickly—in the COMPLETE line

If you have a Penn-Union Catalog, you can instantly find practically every good type of conductor fitting. These few can only suggest the variety:

Universal Clamps to take a large range of conductor sizes; with 1, 2, 3, 4 or more bolts.

L-M Elbows, with compression units giving a dependable grip on both conductors. Also Straight Connectors and Tees with same contact units.

Bus Bar Clamps for installation without drilling bus. Single and multiple. Also bus supports — various types.



Clamp Type Straight Connectors and Reducers, Elbows, Tees, Terminals, Stud Connectors, etc.

Jack-Knife connectors for simple and easy disconnection of motor leads, etc. Spring action — self locking.

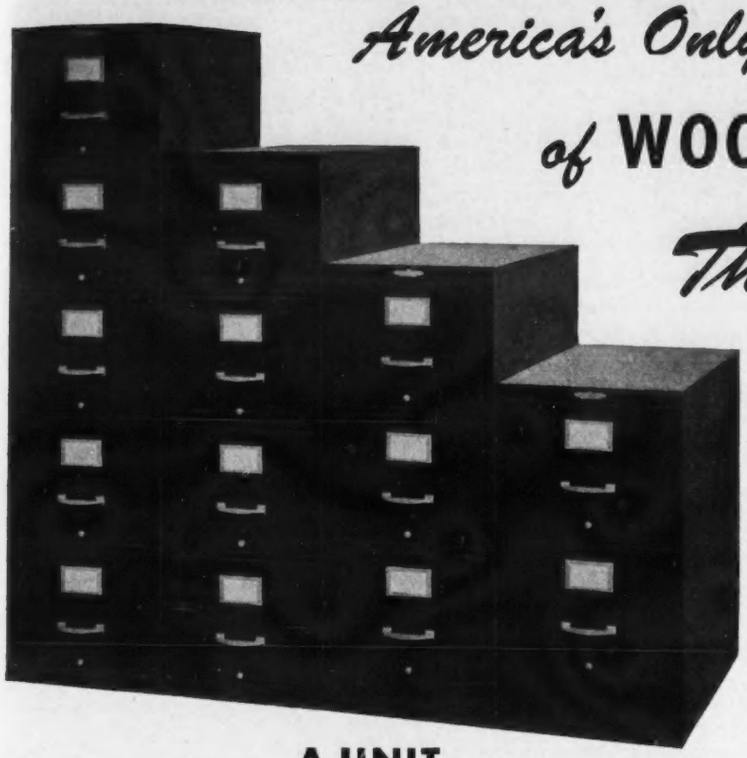
Vi-Tite Terminals for quick installation and easy taping. Also sleeve type terminals, screw type, shrink fit, etc. etc.

Splicing Sleeves, Figure 8 and Oval, seamless tubing—also split tinned sleeves. High conductivity copper; close dimensions.

Preferred by utilities, industrials, electrical manufacturers, contractors — because *they have found that "Penn-Union" on a fitting is their best guarantee of Dependability.*

PENN-UNION ELECTRIC CORPORATION
ERIE, PA. *Sold by Leading Jobbers*

PENN-UNION
Conductor Fittings



America's Only COMPLETE LINE *of* WOOD Filing Cabinets *The Guardsman*

ENGINEERED FOR DURABILITY...

DESIGNED FOR VERSATILITY...

A UNIT TO MEET YOUR EVERY FILING NEED

● In 1943, utilities offices *must* continue to function as efficiently as in peacetime . . . more efficiently, in fact, for there is today far more paper work than ever before, *and far fewer people to do it.*

Of course all available steel now goes to war producers . . . but business records must still be housed conveniently and efficiently. And only Remington Rand can furnish the "Guardsman" . . . the only *truly complete* line of wood filing equipment.

The Guardsman line is just as superlative as any item which bears the Remington Rand label. It's built to *last* . . . and to match in operation, as it does in appearance, your "pre-war" steel files.

See the "Guardsman" at your nearby Remington Rand office today . . . or write to us at Buffalo for a copy of the new full-color manual, "Filing Equipment in Wood." Buy "Guardsman" with confidence . . . use it with satisfaction!

- 5-DRAWER LETTER
- 5-DRAWER LEGAL
- 4-DRAWER LETTER
- 4-DRAWER LEGAL
- 3-DRAWER LETTER
- 3-DRAWER LEGAL
- 2-DRAWER LETTER
- 2-DRAWER LEGAL
- 3-DRAWER JUMBO
- 6-DRAWER 8x5 CARD FILE
- TABULATING CARD FILE
- 5x3 SUBSTITUTE DRAWERS
- 6x4 SUBSTITUTE DRAWERS
- 8x5 and 8x8 CROSS TRAYS
- MAP and PLAN UNITS
- TRANSFER CASES

NO PRIORITY RATING REQUIRED

The Guardsman . . .
another distinguished contribution to your office efficiency in today's wartime economy . . . from

Remington Rand

WIPED OUT FOR GOOD—

The Danger of Transformer Damage Caused by

LOW OIL LEVEL

Guard Vital Oil-Filled Power Transformers with the

MAGNETROL

DOUBLE CHECK SYSTEM

● War industries and necessary civilian activities can brook no interference from power interruptions. Power companies can virtually eliminate one source of power transmission failure by equipping oil-filled transformers with MAGNETROL Low Oil Level Alarms.

Whether low oil level is caused by carelessness, mechanical trouble, accident—or sabotage—this alarm gives instant warning.

MAGNETROLS are positive, dependable. With no packing, bellows or diaphragms, they eliminate the possibility of oil seepage or binding. The cost of equipping transformers with them is small—insignificant, when compared to the tremendous values they protect. Write today for full information.

FRED H. SCHAUB ENGINEERING CO., INC.
329 West Huron Street, Chicago, Illinois

trical Engineers. For the past ten years he has served as special lecturer on electrical machine design at the University of Southern California.

▶J. C. PRICE, formerly distribution supervisor for the Florida Power & Light Co. at Melbourne, has been appointed manager for the utility at Titusville to succeed ROBERT S. BOSTWICK who has entered military service.

▶JOHN ROSEVEAR, formerly superintendent of the works engineering department, has been appointed staff assistant in the industrial engineering and equipment department of the Westinghouse Lamp Division, Bloomfield, N. J. Mr. Rosevear has been connected with Westinghouse for twenty years. In his new position he will help coordinate activities of this recently reorganized department, which deals with problems of tooling and the development of new manufacturing processes.

▶JOSEPH F. KELLEY, assistant secretary at the New York office of Underwriters' Laboratories, has retired after serving 20 years with that organization. In his capacity of office manager of the New York office and testing station Mr. Kelley was in constant contact with the many manufacturer-clients of the laboratories who send their products to the Eastern testing station for investigation in regard to fire and accident hazards. His successor has not yet been named.

▶H. J. MANDERNACH has been appointed sales manager of the replacement tube section of General Electric Co.'s radio, television and electronics department at Bridgeport, Conn. In his new position, Mr. Mandernach is responsible for replacement sales of all types of electronic tubes handled through distributors.

▶AGNES M. WILSON of Trenton, Mo., has been appointed by Gov. Forrest C. Donnell to serve as a member of the Missouri Public Service Commission for an unexpired term ending April, 1943. She has been secretary of the commission since October, 1941, and is the first woman to be made a member of the commission.

▶J. W. BELANGER, assistant manager of the federal and marine department of the General Electric Co., has been appointed manager of that department, succeeding D. W. Niven, manager since 1921. Mr. Niven will continue as a member of the department available for consultation and special duties. Mr. Belanger entered the General Electric "test" course at the Lynn Works in 1917. He then was transferred to Schenectady and subsequently to Philadelphia, returning to Schenectady in 1940 as assistant manager of the federal and marine department.

Put your imagination on overtime!

Ideas to speed production—to effect economies of time and effort—to save materials—these will make the American secret weapon that will win the war.

Put your imagination to work—for your own satisfaction, for job advancement, for increased production in the war effort. Stimulate your, and your employees' creative potentiality by reading this new book.

Just Out

HOW TO "THINK UP"

By ALEX OSBORN
Executive Vice-President, Batten, Barton, Durstine & Osborn, Inc.

Price—50 cents

All over the country factories have worked out employee suggestions systems, because for increased production and the release of manpower. Some of the results of these suggestions systems are truly amazing.

Donald Nelson says, "Through suggestions systems this improved production art is being brought to the surface. The millions of little improvements that save an hour or a pound of brass make it devastating. In their aggregate these will amass our production victory."

In this book Alex Osborn tells how some of these ideas have been thought up and sketches a method for stimulating the thinking up of ideas. His booklet will spark the imagination of the individual, and prove a boon to the executive who is seeking to install or develop an employee suggestions system.

- **It describes scores of valuable ideas that have come from factory workers and explains how they were thought up.**
- **It further outlines a method for anyone to follow in stimulating his ability to "think up."**
- **You will want to play the figure-of-speech game (see page 28) for the fun of it. It's a real imagination developer.**
- **You will want to try the once-a-week imagination exercise described on page 32.**
- **You will approve too the common-sense suggestions on pages 34 and 35.**

John Collyer, President of B. F. Goodrich, says, "Nearly all of us have more imagination than we ever put to work. Too often we either do not try hard enough to think things up, or are too modest to hand in ideas which occur to us. For victory's sake, let us put our imaginations on overtime!"

Let this book help you. You will enjoy reading it—and every page of its sensible suggestions will guide you to personal profits. Send for a copy for 10 days' examination, subject to approval or return, today. Just mail this coupon.

FREE EXAMINATION COUPON

McGraw-Hill Book Co., 330 W. 42 St., N. Y. C.

Send me Osborn's How to Think Up for 10 days' examination on approval. In 10 days I will send 50 cents, plus few cents postage, or return book postpaid. (Postage paid on cash orders.)

Name .....

Address .....

City and State .....

Position .....

Company .....W. 1-23-43

Slit It Open and SEE the Difference

Two important factors govern the selection of wire and cable for "hot-spot" service in steel mills, power plants and various vital industries. First, the conditions under which the circuits must operate, such as around soaking pits, boilers, furnaces, steam lines, drying ovens, rheostat grids; places where resistance to heat and moisture, corrosive fumes, oil, grease and even fire is essential. Second, and most important, is the construction of the wire—its in-built ability to stand up under these severe conditions.

Rockbestos A.V.C. Power, Motor Lead and Lighting Wires and Cables (Underwriters' and N.E. Code, Type AVA) meet the requirements of "hot-spot" service with permanent insulation that won't bake brittle, crack, bloom, swell or rot and has a maximum operating temperature rating of 110° C. (230° F.).

Apply the knife-test to a sample of Rockbestos A.V.C. and you'll find the answer to production losses and unnecessary maintenance due to wire-failure beneath the braid. Send for a sample and dissect it yourself. Rockbestos Products Corporation, 878 Nicoll St., New Haven, Conn.

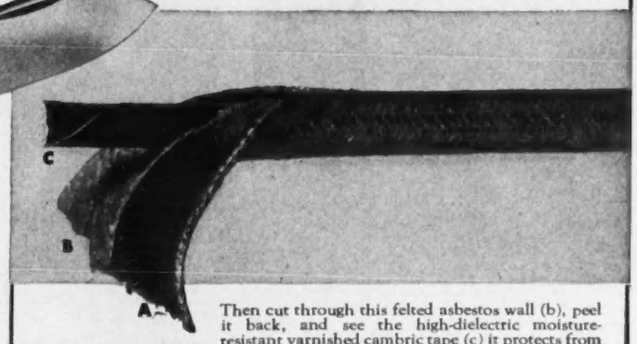
ROCKBESTOS A.V.C.

The Wire with Permanent Insulation

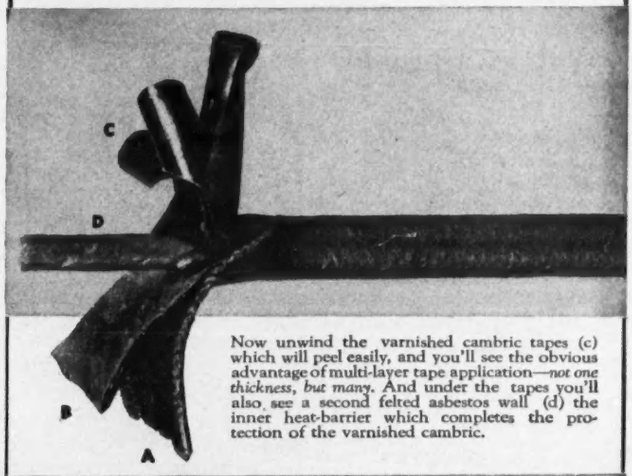
122 different permanently insulated wires, cables and cords

developed by Rockbestos for various severe operating conditions

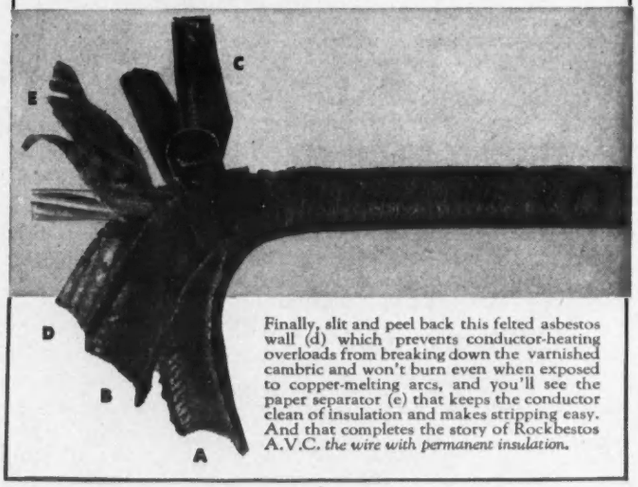
Take a sample of Rockbestos A.V.C. Power Cable, illustrated, or similarly insulated Motor Lead Cable, slit open the slick-finished heavy, heatproof, fireproof asbestos braid (a) which is resistant to moisture, oil and grease, and you'll find beneath a firewall of felted asbestos (b) a permanent heat-barrier against high ambient temperatures.



Then cut through this felted asbestos wall (b), peel it back, and see the high-dielectric moisture-resistant varnished cambric tape (c) it protects from heat, flame and oxidation. Notice too, the uniform coverage of the tapes, helically applied like the felted asbestos to assure perfect and permanent centering of the conductor in the insulation.



Now unwind the varnished cambric tapes (c) which will peel easily, and you'll see the obvious advantage of multi-layer tape application—*not one thickness, but many.* And under the tapes you'll also see a second felted asbestos wall (d) the inner heat-barrier which completes the protection of the varnished cambric.



Finally, slit and peel back this felted asbestos wall (d) which prevents conductor-heating overloads from breaking down the varnished cambric and won't burn even when exposed to copper-melting arcs, and you'll see the paper separator (e) that keeps the conductor clean of insulation and makes stripping easy. And that completes the story of Rockbestos A.V.C. *the wire with permanent insulation.*

NEW YORK, BUFFALO, CLEVELAND, CHICAGO. PITTSBURGH, ST. LOUIS, LOS ANGELES, SAN FRANCISCO, SEATTLE, PORTLAND, ORE.

for NIGHT REPAIRS *and* LINE PATROL

Linemen's Flare Lights

An efficient, economical form of portable illumination—giving daylight vision for night repairs and line patrol work. Unaffected by wind, rain or snow. Two sizes—20 or 30 minute lighting periods.

Central Linemen's Flare Lights are invaluable during outages or other emergencies when quick dependable illumination is imperative. Easily lighted in any weather by self contained friction cap. No matches required. Stick in a post, tree, cross arm, in the ground or carry by hand.

They're always ready, and provide ample illumination. Standard equipment with prominent utilities throughout the land.

STANDARD PACKING

No. 3020—20 min., per case of 72...$12.00
No. 3030—30 min., per case of 36... 9.00

Central Railway Signal Company, Inc.
272 Center Street
NEWTON, MASS.

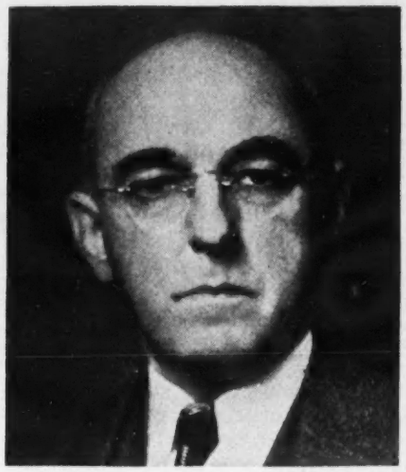
Plant Locations: Hammond, Ind.; Needham Hts., Mass.

OBITUARY

Edwin H. Cheney

Edwin H. Cheney, a vice-president of the Wagner Electric Corp., St. Louis, Mo., died on December 18 in that city, in his seventy-fourth year.

Mr. Cheney had been identified with Wagner Electric since 1909, when he became district manager of the Chicago office with a territory that extended all



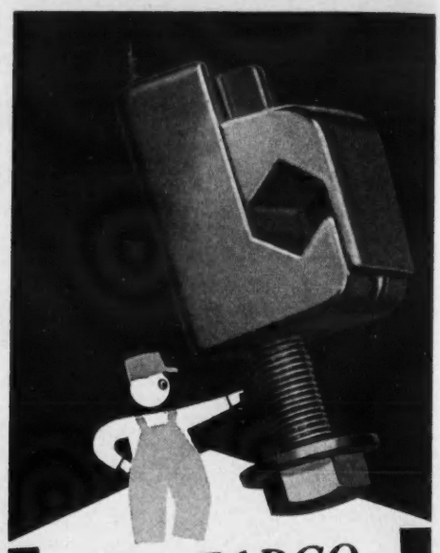
the way to the West Coast. During the last war he was called into the home office in order to take over temporarily the supervision of all Wagner's district offices. At the conclusion of the war he returned to his original position with the company in Chicago. He became vice-president in charge of sales for Wagner in 1926, at which time he moved to St. Louis. He held this position until his death.

A native of Shelbyville, Ill., and a graduate of the University of Michigan, Mr. Cheney first went to work for the Detroit Edison Co. and subsequently became identified with the Commonwealth Edison Co. of Chicago. After a few years he organized an engineering firm of his own in Chicago, having become an expert fuel engineer. He was one of the pioneers in this industry and contributed materially to the increased efficiency of power and heating plant boilers. His connection with Wagner Electric followed in 1909.

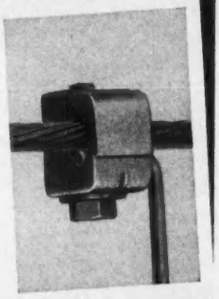
Mr. Cheney participated actively in the affairs of the National Electrical Manufacturers Association.

•

► R. M. SPURCK, manager of sales of the circuit breaker section, switchgear division, central station department, General Electric Co., died at his home in Llanerch, Pa., on December 12. Mr. Spurck was born in Nebraska in 1888 and received his technical education at the University of Illinois and Union



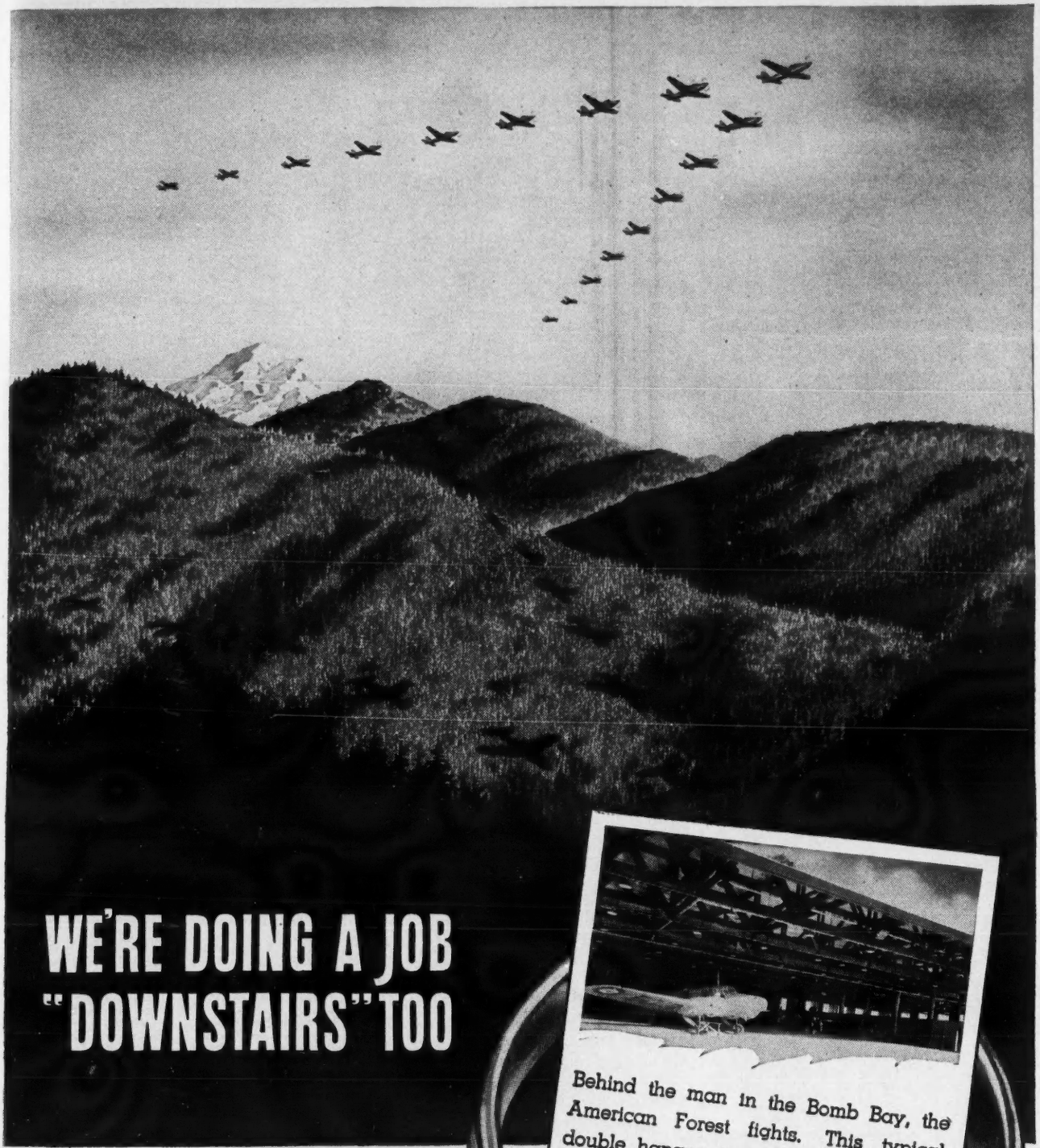
Why FARGO **CONNECTORS** *"grip like a vise" at low torque*



The small bolt in the Fargo Connector means less friction area in turning . . . *less friction* as you tighten the connector. And the perfect machining of the bolt and body of the Fargo Connector further increases ease of tightening . . . further assures high pressure contacts at remarkably low torque. Specify Fargo Connectors for *repeat use,* too.

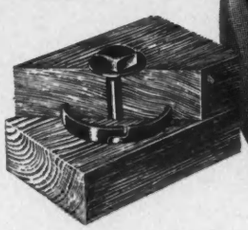
Made by FARGO MFG. CO.
Distributed by

LINE MATERIAL CO.
MILWAUKEE, WIS.



WE'RE DOING A JOB "DOWNSTAIRS" TOO

Behind the man in the Bomb Bay, the American Forest fights. This typical double hangar, timber engineered with TECO-connectored timber trusses, houses Uncle Sam's fighting war birds. You also, can now have clear-span timber trusses—as wide as 200 feet. *Write Us Today.*



The TECO Ring Connector spreads the load on a timber joint over practically the entire cross-section of the wood . . . brings the full structural strength of lumber into play.

Timber ENGINEERING COMPANY

WASHINGTON, D. C. PORTLAND, OREGON

FREE IDEAS

on how to

SAVE HOURS OF WORK WITH BETTER TOOLS

ASK FOR THIS LITERATURE SHOWING HOW GREENLEE TOOLS CAN SPEED UP YOUR CONSTRUCTION JOBS

Get the facts about the complete line of Greenlee Benders and attachments for tubing, conduit, pipe, and bus-bar ranging from ¼ to 4½ inches, in the Greenlee Bender Booklet, S-116.

BENDERS

This Greenlee Folder S-114 describes the handy Greenlee Knockout Tools for enlarging knockouts and holes in metal without long tedious drilling, reaming, or filing.

KNOCKOUT TOOLS

The Greenlee Cable Puller Folder S-115 shows how this handy tool, which clamps right on to the conduit through which the cable is pulled, can make the tough job of cable pulling easy for the electrician.

CABLE PULLERS

Here's the Greenlee Folder S-113 which describes a few of the popular fast and smooth-boring bits from the complete line of Greenlee Boring Tools.

BORING TOOLS

For the contractor interested in learning how to lower underground pipe installation costs, this Greenlee Folder S-117 describes the powerful Greenlee Hydraulic Pipe Pushers.

PIPE PUSHERS

MAIL COUPON TODAY

Please send: ☐ S-116 Bender Booklet ☐ S-114 Knockout Tool Folder ☐ S-115 Cable Puller Folder ☐ S-113 Boring Tool Folder ☐ S-117 Pusher Folder.

Name_____

Address_____

City_____ State_____

My Jobber Is_____

GREENLEE TOOL CO.

1801 Columbia Ave., Rockford, Illinois

College. He became identified with General Electric in 1910, and in 1935 was appointed to the position he held at the time of his death.

► JAMES J. O'REILLY, 56, credit manager of Graybar Electric Co., Los Angeles, for the past 17 years, died suddenly, of a heart attack, in his office on December 30. He had served with the Graybar company for the past 35 years, working in Cincinnati and Seattle previous to joining the Los Angeles office in 1925.

► FRANK A. GARDNER, assistant superintendent of the underground distribution system of the electrical department of the city of Jacksonville, Fla., and an employee of that department for the past 29 years, died suddenly on December 12. He was 62 years old.

► FORREST R. HOPKINS, 46, for the past 15 years a member of the power sales engineering staff of the Worcester County Electric Co. and its predecessor, the Worcester Electric Light Co., died at his home in Worcester, Mass., and December 20. He joined the company about 19 years ago as an engineer in the distribution department.

► FRANK C. WINTERS, manager of the Cincinnati office of the Electric Controller & Mfg. Co., died in that city on January 10. He was 39 years old. After graduation from New York University, Mr. Winters was first employed by the Philadelphia Electric Co. before joining the Electric Controller & Mfg. Co. in 1929. He was in Philadelphia and Baltimore for Electric Controller before assuming charge of the Cincinnati district.

► JOHN T. FAGAN, inventor in the world of lamp making, died on January 2 at his home in Cleveland Heights, Ohio, after an illness of several years. For more than 40 years, 25 of them as manager of the lamp equipment and equipment development works of General Electric lamp department, Cleveland, Mr. Fagan contributed hundreds of inventions to the lamp-making art. Born in Harrison, N. J., in 1871, Mr. Fagan embarked on his career as a tool maker with the Edison Lamp Works of General Electric at Harrison in 1895. After six years with that organization, he served for three years with the Bryan-Marsh Co. at Marlboro, Mass. From 1903 to 1913 Mr. Fagan was Cleveland (Ohio) manager of the experimental division of the then National Electric Lamp Association. Shortly after 1913 he rose to his full stature as an inventor. Mr. Fagan retired from General Electric in 1938 and had since taken an active interest in the affairs of the T. & F. Engineering Co., Cleveland, where he was chairman of the board at the time of his death.

Now—102 engineers and scientists make the new

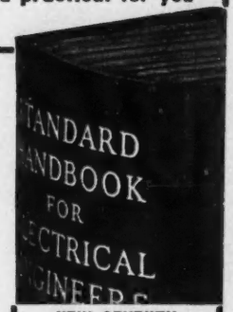
STANDARD HANDBOOK *for* ELECTRICAL ENGINEERS

dependable and practical for you

Archer E. Knowlton, *Editor-in-Chief*

Associate Editor for Engineering, Electrical World

7th Edition, 2303 pages 6x9, 1700 illustrations, 600 tables, $8.00



NEW SEVENTH EDITION

- every section fully revised
- whole new sections; actually hundreds of pages of new material
- more contributors; every section treated by an expert
- new format; larger diagrams

HERE is the great standard reference work of all in the electrical engineering profession or whose work in industry or engineering touches on this field. Its 2303 pages present a handy - reference compilation of practical, usable data from all fields of electrical engineering practice, plus the most frequently required fundamental theory, units, and systems of measurement, made dependable by the work of more than 100 engineers, scientists, teachers, and other authorities.

Thousands of useful facts in these

26 BIG SECTIONS

Units and Conversion Factors
Electric and Magnetic Circuits
Measurements
Properties of Materials
Circuit Elements
Transformers, Regulators and Reactors
Alternating - current Generators and Motors
Direct-current Generators and Motors
Rectifiers and Converters
Prime Movers
Power Plant Economics
Power System Electrical Equipment
Power Transmission
Power Distribution
Wiring Design—Commercial and Industrial Buildings
Illumination
Industrial Power Applications
Electric Heating and Welding
Electricity in Transportation
Electrochemistry and Electrometallurgy
Batteries
Wire Telephony and Telegraphy
Electronics and Electron Tubes
Radio and Carrier Communication
Codes and Standard Practices
Electrophysics

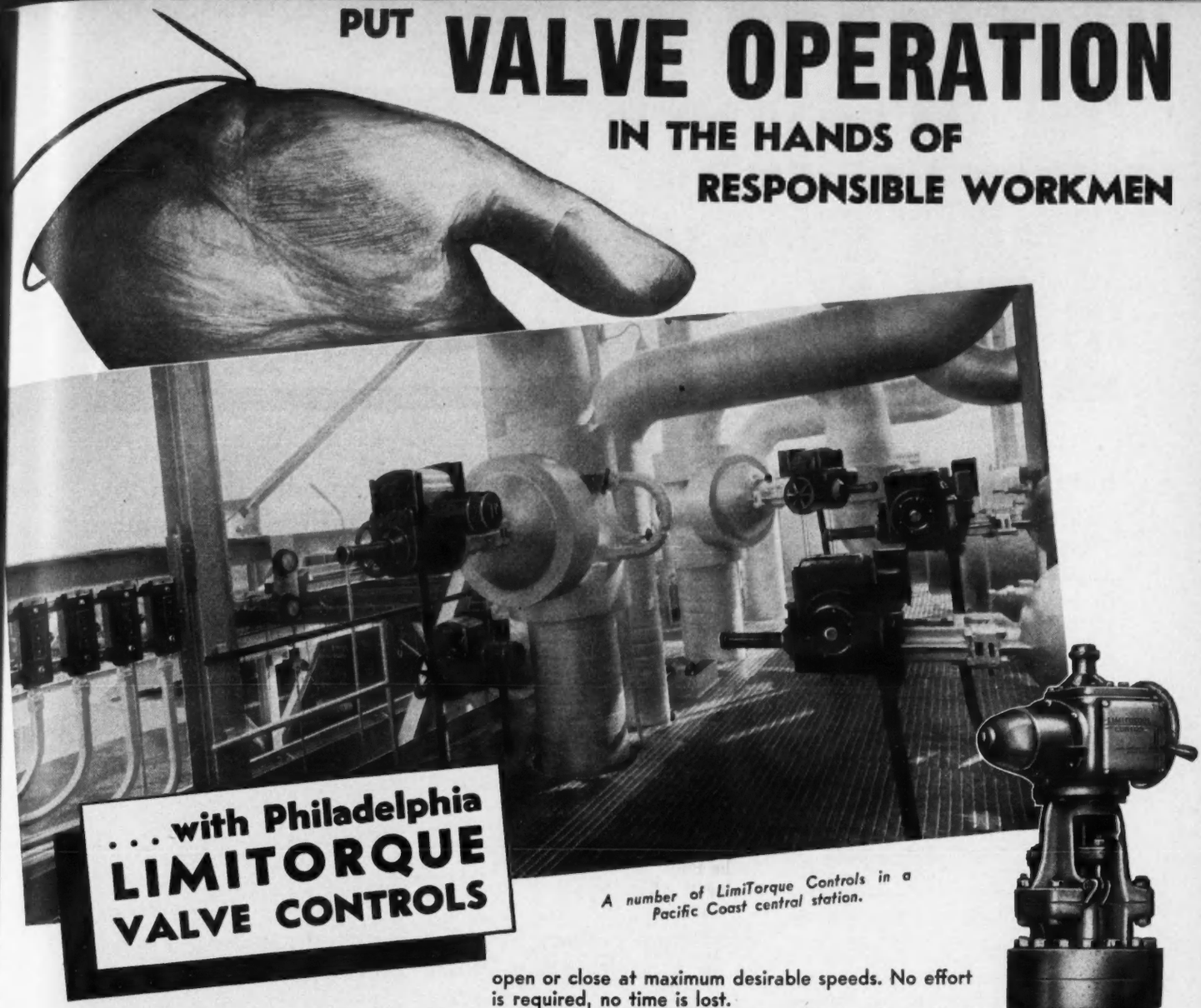
10 DAYS' FREE EXAMINATION

McGRAW-HILL BOOK Co., Inc.
330 W. 42nd St., New York

Send me the Standard Handbook for Electrical Engineers, 7th Edition, for 10 days' examination on approval. In 10 days I will send $8.00, plus few cents postage, or return book postpaid. (We pay postage if you remit with order.)

Name .....
Address .....
City and State .....
Position .....
Company ..... W. 1-23-43

PUT VALVE OPERATION IN THE HANDS OF RESPONSIBLE WORKMEN



. . . with Philadelphia LIMITORQUE VALVE CONTROLS

A number of LimiTorque Controls in a Pacific Coast central station.

Putting the responsibility for opening and closing important valves in the hands of key men is vital today under wartime conditions. By equipping with Limitorque Valve Controls, valves can be operated from central master control panels, or conveniently located push button stations. Valves respond instantly and open or close at maximum desirable speeds. No effort is required, no time is lost.

LimiTorque Controls are adaptable to all types of valves, from 3" to 96" diameter and can be fitted to existing equipment, if desired. Hundreds are in service in central stations, hydro electric plants and private power plants in all parts of the country.

Write now for more information.

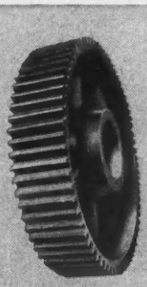
PHILADELPHIA GEAR WORKS

INDUSTRIAL GEARS AND SPEED REDUCERS LIMITORQUE VALVE CONTROLS

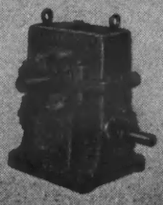
ERIE AVENUE & G STREET PHILADELPHIA, PA.

New York, Pittsburgh, Chicago

***Philadelphia* LIMITORQUE CONTROL** operates all types of valves, etc., safely, economically, from convenient stations.

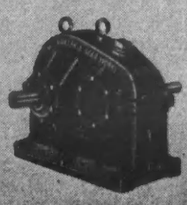


***Philadelphia* GEARS** All types and sizes of industrial gears. Can be supplied in all materials.



***Philadelphia* WORM GEAR SPEED REDUCER** right angle drives — vertical or horizontal. Wide range of ratios and horsepowers.

***Philadelphia* MOTOREDUCER** The economical self-contained drive, Horizontal or Vertical types — various ratios and horsepowers.



***Philadelphia* HERRINGBONE SPEED REDUCER** for heavy loads at high speed. Single, Double, Triple Reductions, various ratios and horsepowers.

MANUFACTURING-MARKETS

Industry's Post-War Role Indicated

Defining the post-war period in America as "the time after 1948," Lewis H. Brown, president of Johns-Manville Corp., recently stated that he looked forward "to the post-war future in the hope we can profit by the mistakes of the twenties, the mistakes of the thirties and the lessons of war in organizing a better way of life for all of us here in America." Mr. Brown spoke on the subject "Using Private Business Agencies to Achieve Public Goals" before the Washington members of the American Economic Association.

Pointing to some of the activities of the Reconstruction Finance Corporation, the Home Owners Loan Corporation and the Federal Housing Authority as examples of real cooperation on sound constructive lines, Mr. Brown said that these government agencies made successful contributions to our national progress. He said that in the post-war period "we must encourage the private enterprise system to carry the load of providing employment to the utmost, so that government's load will be at a minimum." "We have a choice of directions in which to go," said Mr. Brown. "We have a choice of instruments we can use. But, we cannot reconcile the principle of democracy, which means cooperation, with the principle of government omniscience under which every one waits for an order before doing anything. That way lies totalitarianism, loss of freedom and dictatorship . . ."

•

More Plants Get Awards

Additional industrial plants have been recently selected to receive the Army-Navy production award in recognition of performance on war contracts. Among the winners are the following: General Electric Co., Pittsfield, Mass.; Hubbard & Co., Emeryville, Calif.; Babcock & Wilcox Co., refractories division, Augusta Works, Augusta, Ga.; Fairbanks, Morse & Co., Freeport, Ill., and Three Rivers, Mich.; Servel, Inc., Evansville, Ind.; Bethlehem Steel Co., Terminal Island Yard, Terminal Island, Calif.

•

Eagle Electric Expands

Eagle Electric Manufacturing Co. has recently moved into new and more spacious manufacturing quarters in Long Island City. The new factory, located on Bridge Plaza South at the foot of Queensborough Bridge, is a modern reinforced, concrete building containing 135,000 sq.ft. of floor space.

•

Appliance Makers Meet to form Post-War Plans

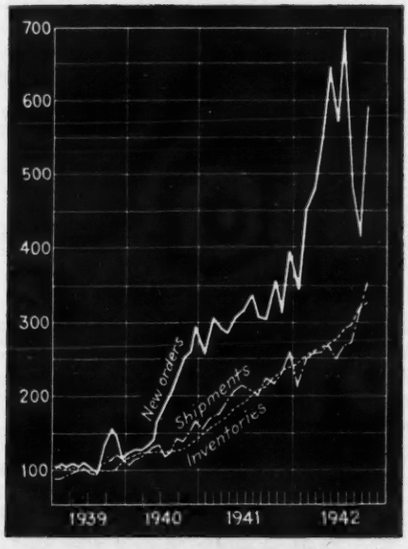
Members of the American Washer and Ironer Manufacturers Association met recently in Chicago to outline a program for resuming their normal manufacturing business after the war. Since early last year the industry has been engaged entirely in war work.

John M. Wicht, president of the association and director of the home laundry equipment division of the General Electric Co., Bridgeport, Conn., was authorized by the members to name a committee to study the elements of post-war planning including new materials, informative labeling, market potentials and new housing developments.

Members also voted approval of a "scrap bank" plan for collecting and conserving critical materials and recommended adoption of the system by the entire industry. The plan was developed by the Easy Washing Machine Co. last year and involves the issuance of certificates for repair parts turned in by dealers. These certificates give an indication of the amount of new metals needed by the industry for supply replacement parts.

Machinery Orders Rise in November

New orders placed with durable-goods manufacturers during the month of November followed mixed trends, according to the report issued by the Bureau of Foreign and Domestic Commerce. Small reductions were registered in some lines, but these were offset by a larger volume of new business in the electrical machinery and iron and steel industries, the report shows. The index moved upward to 592 from 413 (revised) in October.



ELECTRICAL MACHINERY INDICES of Bureau of Foreign and Domestic Commerce

Increased war production pushed the value of manufacturers' shipments to a new all-time high in November. Following the general trend, electrical machinery shipments advanced to 353 from 317 in October.

Electrical machinery inventories index moved only slightly upward to 326.1 from 320.6 the preceding month.

Nicopress SPLICING SLEEVES

Equally Efficient for Maintenance Or New Construction

Because of the ease and speed of installation and the strength of the completed splices, the Nicopress Method of splicing fully meets all requirements.

When the line joints are made with Nicopress Sleeves you can be sure that they will last as long as the line, for Nicopress Splices exceed the rated breaking strength of the conductors.

In making the Nicopress splice the wires go straight into the sleeve meeting end to end without distortion, bending or overlapping, this means the conservation of material (vital today) and permits the splicing of broken lines without changing sag.

As all Nicopress power sleeves are bevelled at both ends, pulling the wire over the cross-arms when stringing is greatly facilitated and snagging on cross-arms is eliminated.

For maintenance or new construction you can't beat Nicopress. Order from your jobber and eliminate trouble at the line joints.

Nicopress SLEEVES *Are Available for* COPPER COPPERWELD *and* HIGH TENSILE STEEL CONDUCTORS —Solid or Stranded

Buy WAR BONDS

THE NATIONAL TELEPHONE SUPPLY COMPANY

Manufacturer of Specialties for Power and Communication Lines

5100 SUPERIOR AVENUE • • CLEVELAND, OHIO

Canadian Mfr.—N. SLATER CO., LTD., HAMILTON, ONT., CANADA

Export Distributor—INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.

BIAS TAPES *with plenty of* STRETCH!

ACME bias tapes fit snugly around corners, into slots and over uneven surfaces because they have exceptional flexibility (stretch), and the tensile strength to stand the pull. These qualities are due to an Acme-developed process of applying pure vegetable oil varnishes of Acme formula to highest grade cotton fabric. Available in bias or straight tapes and rolls up to 36" wide—yellow or black. Samples if desired.

Acme Wire PRODUCTS

The Acme Wire Co., New Haven, Conn.
MAGNET WIRE—COILS—VARNISHED INSULATIONS

ELECTRITE
A high grade fibre board for electrical insulation. A material of quality possessing high tensile and dielectric strength. Used by many of the leading manufacturers of electrical equipment.

DENSITE
An extremely hard board of superior quality which can replace the more expensive types of insulating materials.

Pulp Products Department
WEST VIRGINIA PULP & PAPER COMPANY
230 Park Avenue, New York, N.Y. 35 E. Wacker Drive, Chicago, Ill.

Test Insulation the Modern Way
with a MODEL B-5
MEGOHMER

NEW BATTERY-VIBRATOR TYPE
No more tiresome cranking of a hand-driven generator . . . Entirely self-contained, steady test potential of 500 volts DC, available at the touch of a switch. Direct reading in insulation resistance.

HERMAN H. STICHT CO., INC.
27 PARK PLACE NEW YORK, N. Y.

WRITE FOR BULLETIN No. 430

Alcoa Releases Patents on Use of Armor Rods

Transmission line engineers will be interested in the fact that U. S. Patents No. 1,639,820 and No. 1,873,798, held by the Aluminum Co. of America, covering the use of armor rods have been given to the public. A deed of public dedication has been filed by ALCOA and recorded in the U. S. Patent Office in Washington. This makes available to all, for all conceivable uses, and without the need for licensing procedure, a practice which has previously been employed largely with a single type of transmission line cable.

Armor rods resemble an extra layer of heavy strands covering the cable for a short distance at points of support. Invented originally for the purpose of protecting cables from fatigue produced by resonant vibration, they increase the resisting moment of the cable at the point of support.

•

G.E. Institute Broadens Wartime Services

A broad development program designed to make wartime services of the General Electric Consumers Institute available to still greater numbers of America's homemakers has been announced by H. L. Andrews, vice-president of General Electric Co. and manager of the appliance and merchandise department at Bridgeport, Conn.

"For many years the G.E. Institute has proved most popular with a great many women, who have found it a friendly source of helpfulness in homemaking," said Mr. Andrews. "In wartime the laboratories, test kitchens and laundries of the institute are proving more vital than ever, with constantly growing numbers of homemakers seeking advice and counsel on meeting those problems within the home, brought about by shortages and restrictions."

The development program planned will offer every homemaker up-to-the-minute information for the practical solution of wartime homemaking problems as they arise, according to Mr. Andrews. Publication of the institute's research findings and laboratory studies will continue as in the past, in the form of handy pamphlets, booklets and folders.

•

N.E.W.A. Moves Offices

National Electrical Wholesalers Association has announced the removal of its office to 500 Fifth Avenue, New York. The association was formerly located at 165 Broadway.

Field Reports on Business

War production is booming throughout the country; industrial employment and payrolls are at peak levels. Demand for electrical equipment is varied and remains considerably below the requirements of this period last year. Maintenance items are being extensively sought.

NEW ENGLAND

Industrial electrical equipment sales are holding up well and are maintaining a fairly steady level with machine tool builders buying quite regularly in fair-sized lots. Several groups of small motors, numbering from 50 to 100 each, have been booked during the past week. Machine tool builders are still receiving some foreign orders for special milling machines, grinders and lathes. Florence Stove Co., Gardner, Mass., has installed 125 kw. in infrared heating equipment. A Boston munitions plant has recently added eight electric furnaces aggregating 800 kw. in rating.

Connecticut non-ferrous metal firms have booked encouraging orders for condenser tubes and copper wire; a sizable volume of supplies for wiring for temporary construction in various Army areas including outlet boxes, switch boxes, porcelain tubes, reflector shades and wire has been bid on by distributors. Massachusetts manufacturers have submitted bids for ten electrically driven stacking and tiering machines and quotations for signal lamps and accessories have been submitted by a Connecticut firm.

B. F. Sturtevant Co., Hyde Park, Mass., has received an order to install ventilating equipment in shops, officers quarters, and other rooms connected with a floating dry dock now being built on the West Coast. Quartermaster supplies contracts awarded to New England firms should insure more active markets for electrical equipment than normally in leather, rubber and textile fields.

CHICAGO

Activity on war production is booming throughout this area with output steadily mounting as additional government orders continue in substantial volume. Industrial employment and payrolls are at peak levels and the demand for war workers is still growing. Retail trade fell off somewhat last week but is still ahead of last year. During the past week 66 companies were awarded 122 war orders, including 10 receiving initial war orders. Contracts for electrical equipment included, Birtman Electric Co., machine supplies; William Meyer Co., small motors; Schweitzer & Conrad, disconnecting switches; Simpson Electric Co., construction contract on plant facilities.

Demand for electrical equipment is varied and, on the whole, considerably under last year at this time. Of 25 manufacturers reporting December sales to the Electric Association, 13 showed gains over November while 15 registered declines from December, 1941.

There is a fairly heavy demand for fluorescent lighting equipment, small motors, control apparatus and welding equipment. Production and maintenance items are being extensively sought. What few appliances remain are being snapped-up. Bids are requested for electrical work on the state hospital at Alton, including transformer vault, power distribution panel, metal and fibre conduit.

Defense Plant Corporation has authorized a contract with Standard Oil Co. (Ind.) to provide plant facilities in Illinois, costing in excess of $13,000,000. General Electric Company was awarded contract exceeding $100,000 for additional equipment in a plant in Indiana.

PACIFIC COAST

Wholesalers report continued good business, the larger items covering wiring devices for housing projects, heavy plant and deck cable, and navy and maritime wiring equipment, especially since the large number of new keels laid down began to register their electrical needs.

New government construction seems to be temporarily meagre compared with housing, but includes a $1,500,000 ammunition depot near Hermiston, Ore.; a $1,000,000 installation for U. S. Engineers in Fresno County, and new or enlarged hospitals at Ketchikan, Alaska; Vancouver, Wash., and in San Bernardino County, Calif., and Nye County, Nev., the two latter considerably exceeding $1,000,000 in cost. Housing construction, however, is continually increasing as labor shortage becomes increasingly acute and general contractors and war plants are striving to recruit for it in distant areas.

No governmental appropriation has been made for California Central Valley project for fiscal year beginning July 1, 1943, but funds remaining from previous year's appropriation of $39,000,000 are expected to complete Shasta Dam, install two 75,000-kw. generators and construct 97 miles of transmission line to Oroville.

Recent orders include $16,419 G.E. carrier current material for Los Angeles, $32,000 of transformers and switchgear equipment for Pacific naval bases, a 2,000-kw. indoor substation complete with transformers, totaling $75,000, for a Hawaiian airbase, and a low bid of $16,160 covering eight 600-amp., 15-kv. Kelman circuit breakers for Los Angeles.

NEW YORK

F. Vaux Wilson, vice-president of the Homosote Co., pioneers in developing prefabricated houses, predicts that there will be a demand for 900,000 new dwelling units in the second year of the peace and that the demand will reach 1,600,000 units annually within a ten-year period. Many new outlets would be used in the post-war housing business, he predicted, "including department stores and wholesale distributors of appliances and equipment."

Department store sales for the week ended January 9 were up 6 percent over the corresponding period in 1942, the Federal Reserve Board reports. In the New York area, however, they were off 6 percent and in Philadelphia they were off 3 percent. Only Boston showed a gain in the East with an 11 percent increase. December chain store sales showed a 4.6 percent gain in December.

Engineering construction volume for the week, $53,113,000, is 36 percent below the corresponding 1942 week and 17 percent under the previous week's total, according to the *Engineering News-Record*. The current week's total brings the construction total for 1943 to $117,041,000, 37 percent below the three-week period in 1942.

RELIABLE
Connectors

Save Time
by using solderless connectors with accurately fitting precision threads which insure easy, permanent installations.

Save Copper
by using these connectors which are good as new after being salvaged.

EASY TO INSTALL
LOW IN COST

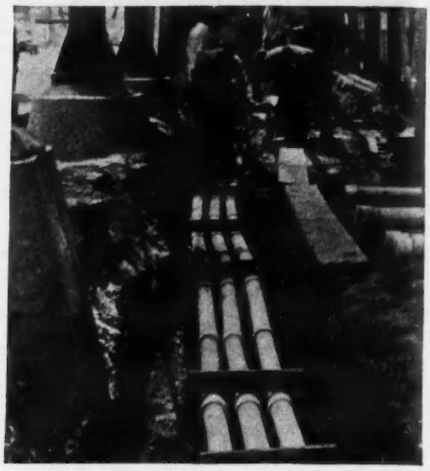
Reliable ELECTRIC COMPANY
OVER 30 YEARS SERVICE TO THE UTILITIES

For peak efficiency

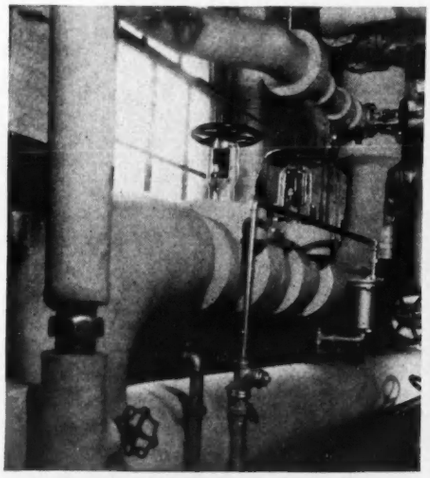
WARTIME RESTRICTIONS recognize the imperative need in the electrical industry for necessary repairs and maintenance. WPB Order Nos. P46 and P46-A grant specific permission to those possessing required priority ratings to purchase materials needed for this purpose.

To help you avoid waste, save fuel and cut costs, Johns-Manville brings you the knowledge accumulated during 85 years of experience. Throughout the electrical industry, J-M products are today contributing to the war effort, and will tomorrow be available for the resumption of peacetime activities.

For complete details on any or all of the products described here, write for Catalog GI-6A, Johns-Manville, 22 East 40th Street, New York, N. Y.



TRANSITE CONDUIT. Made of asbestos fiber and cement, Transite Conduit is approved for use underground without Concrete envelope. Both Transite Conduit and Korduct help provide lower installation cost and reduced maintenance expense.



ASBESTO-SPONGE FELTED Pipe Insulation is recommended where maximum efficiency, high salvage and resistance to abuse are essential. Used alone for steam lines up to 700° F.; for higher temperatures, used in combination with Superex.

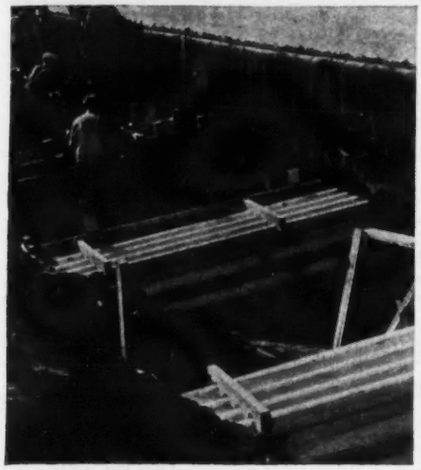
FIRECRETE CASTABLE REFRACTORIES. You can cast special shapes yourself... quickly and easily... and have them ready for service within 24 hours . . . by use of J-M Firecrete Castable Refractories. Ideal for poured door linings.

J-M SEA RING PACKINGS provide a minimum of friction on rods and plungers. They automatically seal on the work stroke, and release on the return stroke . . . thus reducing friction, minimizing rod wear, and conserving power.

JOHNS-MANVILLE

JOHNS-MANVILLE

with present equipment



TRANSITE KORDUCT. Korduct is identical with the Conduit except for its lesser wall thickness. Like Transite Conduit, Korduct is fireproof and highly resistant to internal or external corrosion, electrolysis and action of soil chemicals.

DUXSEAL. A non-hardening, adhesive, plastic compound that will not slump or flow. Used for sealing the openings between cables and duct walls in manholes, service entrances, riser ducts, etc. Comes in 5-lb. pugs, 1-lb. packages and 70-lb. containers.

CABLE FIREPROOFING. Niagrite-Asbestoment, a commercially pure asbestos tape with or without reinforcement, which when wrapped on electrical cables and covered with Asbestoment (an efficient refractory) forms a fireproof protection.

J-M ELECTRICAL MATERIALS not shown here include:
Cable Trays, Asbestos Ebony, Moulded Ebony, Electrobestos, Asbestos Tapes, Friction Tapes and Splicing Compounds

OTHER JOHNS-MANVILLE PRODUCTS FOR THE ELECTRICAL INDUSTRY

HIGH TEMPERATURE INSULATIONS
REFRACTORIES
TRANSITE PARTITIONS
ACOUSTICAL MATERIALS
PACKINGS
BUILT-UP ROOFING
INDUSTRIAL FLOORING
TRANSITE PRESSURE PIPE

ELECTRICAL MATERIALS

NEW
EMERGENCY
COMMUNICATION
FACILITIES

are available to power companies as a result of DOBLE research and development in 1942. In addition to an expanded program of electrical insulation maintenance for an increased clientele.

DOBLE
ENGINEERING
COMPANY

•

MEDFORD HILLSIDE,
MASSACHUSETTS

Recent Rate Changes

ALABAMA POWER CO. has petitioned the state Public Service Commission for permission to extend its "objective" rate to certain rural communities and cities in which it is not in effect. It is estimated that 10,650 rural families will save approximately $52,620 a year under the "objective" rate, and the cities affected about $6,000. Thomas W. Martin, president, in explaining the reason for the petition, stated: "The proposed rate is designed to extend the benefits of existing 'objective' rural rates to those customers who, because of war restrictions on the manufacture and sale of electrical equipment, cannot increase their use of electric service. Included in the petition is a plea for establishment of a new municipal street lighting rate to be known as F-5. This rate will give to municipalities unable to increase their street lighting because of shortages of critical materials and now billed at the 'objective' street lighting rate, the advantages of this rate and will result in annual savings of approximately $6,000 for the municipalities affected." The commission approved the new rates by a 2 to 1 vote.

ARKANSAS POWER & LIGHT CO., losing its appeal in the Pulaski Circuit Court, is proceeding to make a refund of $625,000 to certain of its customers as was ordered by the Arkansas Department of Public Utilities, without appealing to the state supreme court. "We contended the commission has no authority to make a retroactive order and was without power to order a refund," C. Hamilton Moses, president of the company, said. "But the Circuit Court has ruled against us, and we will act as directed." Mr. Moses said that individual refunds would be made to about 100,000 customers on the basis of 1942 electric bills as soon as statements can be compiled. The Department of Public Utilities has offered to lend some of its staff members to the power company to aid in the tremendous task of figuring the refunds for the customers.

CENTRAL ARIZONA LIGHT & POWER CO. has been ordered by the state Corporation Commission to establish new electric rate schedules, which, according to the commission, will result in savings to consumers of $300,000 annually based on 1942 business, and $350,000 based on anticipated 1943 business. The order was issued, the commissioners said, in anticipation of delivery of firm energy to the company beginning January 1 from Parker Dam. They added that the new rate schedules would allow an earning on capital investment of 6½ percent. All of the rate schedules were changed. The three residential rates were consolidated into two, one for residences and individually metered apartments within the City of Phoenix and another for those outside. Under the old schedule there was a rate for the city, another for the metropolitan district and still another for outlying communities. Irrigation rates set up, the commissioners said, vary from a maximum of nine mills per kilowatt-hour to a minimum of seven mills, the previous rate being 12½ mills.

PENNSYLVANIA PUBLIC UTILITY COMMISSION has announced that it has instituted an investigation upon its own motion for the purpose of determining the fairness, reasonableness and justness of the rates and charges of Pennsylvania Power Co., general offices at New Castle. The investigation is to include consideration of the imposition of temporary rates. In the order instituting the investigation, the commission states that it has information indicat-

Our Part

★

45,000 more kilowatts installed for use by war industries.

3 times as much electricity furnished to industry as in 1939.

3,300,000 gallons of oil per month saved by conversion to coal.

50,000 miles of automobile use saved per month by conservation and customer cooperation.

61 employees released to war service, and not replaced.

Almost $3,000,000 paid in taxes.

★

THE
HARTFORD
ELECTRIC LIGHT
COMPANY

ing that the rates and charges may be unjust and unreasonable, and produce an excessive rate of return. In a separate order the commission suspended for a period of six months, from December 18, 1942, to June 18, 1943, pending hearing and decision, a proposed increase in industral rates, which the utility intended to make effective December 18. Chairman John Siggins, Jr., voted in the negative on both orders.

TRI-CITIES UTILITIES Co. has been granted a restraining order in the Circuit Court in Frankfort, Ky., enjoining rate reductions for Frankfort electricity consumers pending a hearing of the case on its merits. In granting the restraining order, Judge W. B. Ardery ordered the utility to set aside $6,560 each month to cover rebates to consumers in case the rate cut ordered by the state Public Service Commission gets final court approval. The 22.3 percent reduction the commission ordered to take effect with bills for the November consumption period was estimated to total $78,720 a year to users of domestic and commercial energy. In asking the court to enjoin the reduction, the company contended such a lowering of its charges would reduce its income to less than 2 percent on its property. The City of Frankfort and a group of local consumers represented by Sam H. Brown, attorney, were permitted by Judge Ardery to intervene in the suit, both opposing Tri-City's efforts to prevent the reduction.

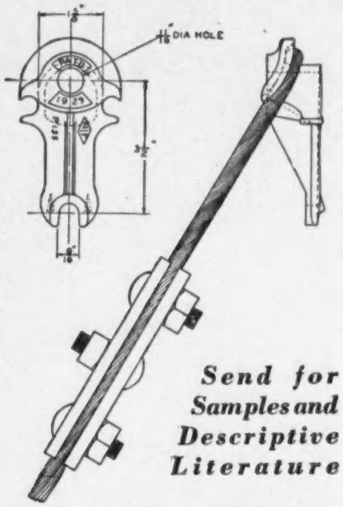
MANITOWOC, WIS., PUBLIC UTILITIES COMMISSION has been authorized by the state Public Service Commission to revise its electric rates downward, effective January 1. The lowered schedule will mean an annual saving of $30,300 to electric customers of the municipal utility.

WATERLOO, WIS., municipal utility plant customers will obtain a reduction in electric rates, the state Public Service Commission has announced, amounting to $2,250 annually for residential users and $2,700 for small commercial and industrial users.

UTAH PUBLIC SERVICE COMMISSION has resumed hearings at Salt Lake City on a valuation of Utah Power & Light Co. properties for rate making purposes. The commission seeks rate reductions of upwards of $1,000,000, based on an original cost value determined by the Federal Power Commission. In sessions recessed in December testimony was introduced by both FPC and company officials relating to various methods of valuation. A fair original cost valuation of $50,769,559 and a prudent investment rate base of $64,052,877 was placed on the property by the commission. Company officials claimed an original cost figure of $66,908,440 and a present value of approximately $95,000,000, taking into consideration the variable value of the dollar. When the sessions were resumed ,the commission representatives continued their examination of George M. Gadsby, president and general manager of the utility. Testimony showing how net revenues of the utility would be affected through loss of its largest consumer, the Utah Copper Co., was introduced. Utah Copper will put into operation this year the first units of its own generating plant. R. H. Jones, treasurer and assistant secretary, was cross-examined with respect to the valuation of the Utah Light & Traction Co. and to engineering fees paid to the Phoenix Utility Co. over a period of about 30 years. At a subsequent hearing the propriety of expenditures of more than $2,000,000 in which the payer and the recipients were all in the Electric Bond & Share Company group was questioned.

Well Past the 1,300,000-Mark

Regular, although small orders for M.I.F. Through-bolt Guy Hooks were shipped all through 1942 to customers constituting over one-half the operating capacity of the U.S. and Canada. For shipments on orders bearing the usual preference ratings we have ample stocks of Guying Devices as listed below for use with 5/8" through-bolts, and larger sizes for 3/4" and 1" bolts, with safety factor over the bolt in each case.



These fittings may be advantageously used first where Through-bolt is already used to apply corner or dead-ending stresses to pole.

Test competitively with present guying specifications by sending assorted trial order at following 100-lot F. O. B. Branford prices:

P135 Guy Hook	$18.20/C
P128 Eye Nut	14.70/C
P143 Curved Washer	7.70/C
P126B Bolt Eye	24.50/C
PA-128-6 Anchor Rod (5/8"x 6 ft. Thimbleless)	66.70/C

Or, we will send sample P135, P128, and P143 without charge or obligation in response to request on Operating Company letterhead.

Use the Guy Hook for anchor guys, and the Eye Nut or Bolt Eye for pole to pole and other relatively flat guys, and the Curved Washer to minimize slotting or splitting stresses in the pole. Fully described in our Simplified Guying Specifications folder.

Send for Samples and Descriptive Literature

Misc. M. I. F. Pole Hardware Specialties: — *Williams Pole Mounts — Pole Stubbing Clamps—Aerial Cable Messenger Clamps and Insulated Hangers—Neutral and Ground Wire Clamps —Malleable Secondary Racks and Clevises—Tubular Pole Fittings—Transformer Hanger Plates for Through-bolt Mounting—Malleable Crossarm Gains—Screw Anchors—Sidewalk Guy Fixtures and Alley Arm Braces—Guy Strand Dispensing Holders—Through-bolts and Double-arming Bolts, etc.*

MALLEABLE IRON FITTINGS COMPANY
Pole Hardware Dept. [Factory and New England Sales Office] **Branford, Connecticut**
New York Sales Office: Thirty Church Street
Canadian Mfg. Distributor:
LINE & CABLE ACCESSORIES, Ltd., Toronto

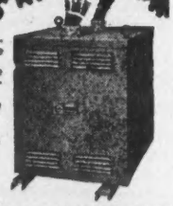
Stop Waste with
TRICO
KLIPLOK CLAMPS
KLIPLOKS ELIMINATE—
- Destroying temperatures
- Burnt fuses and clips
- Premature fuse blowings
- Arcing at contacts
- Wasted current
- Unnecessary shutdowns

Write for Bulletin No. 6

TRICO FUSE MFG. CO., Milwaukee, Wis.
In Canada: IRVING SMITH LIMITED, Montreal

AIR COOLED TRANSFORMERS
50 KVA UP TO 2400 VOLTS

Acme Air Cooled Transformers now available in following ratings.
3 to 50 KVA, 60 cycle, 3 phase 240/480; 600; 2400 volt primary.
1½ to 50 KVA, 60 cycle, single phase 240/480; 600; 2400/4160 volt primary.
Write for Acme Air-Cooled transformer Bulletin.

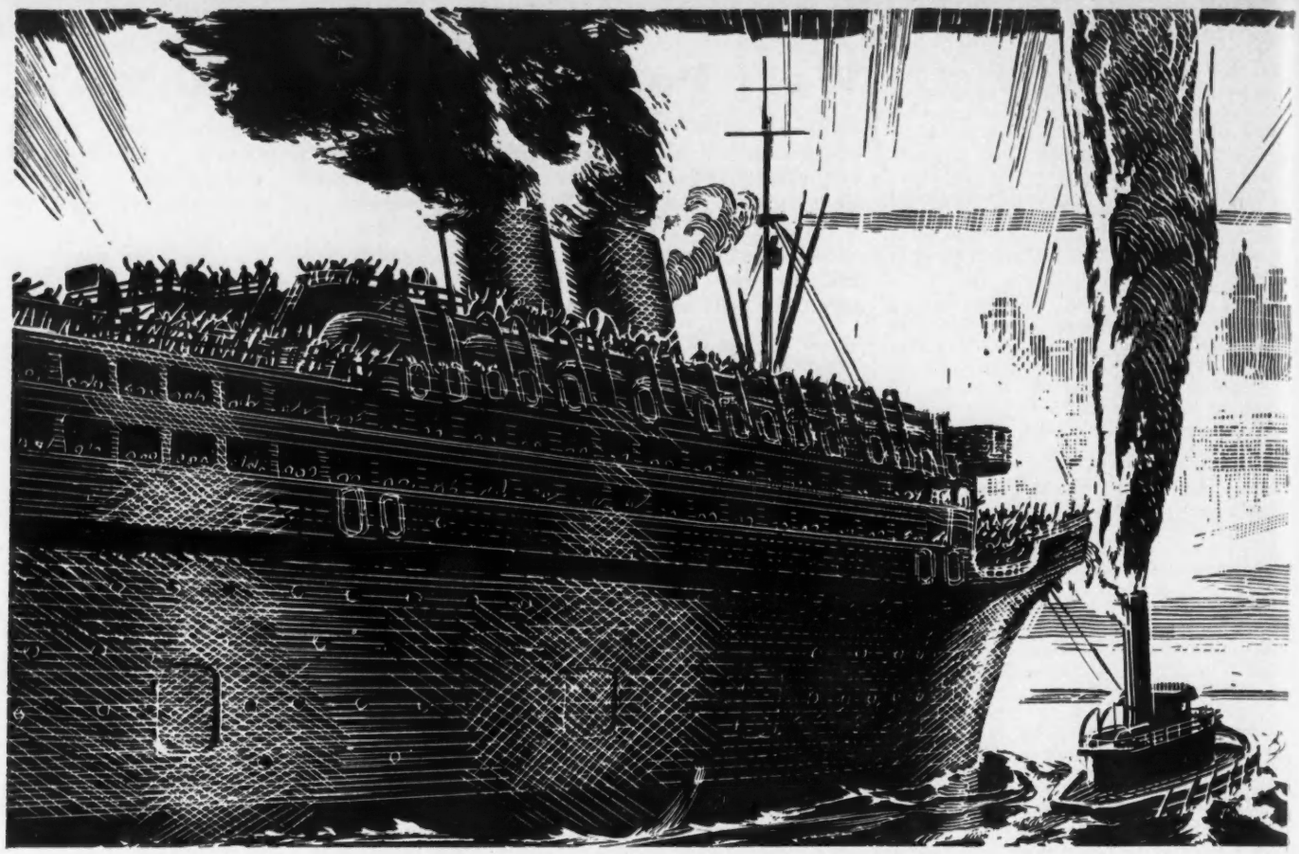


THE ACME ELECTRIC & MFG. CO.
43 Water St. Cuba, N. Y.

Acme Electric

HIGH GRADE HARD PORCELAIN
FOR
Electrical Specialties
High and Low Voltages

IMPERIAL PORCELAIN WORKS
TRENTON, NEW JERSEY



AMERICA...*Where Castles in the*

SOME day, no matter how long and hard the interim, the first transport load of victorious troops will head for home. Long before we see it, men crowded on its decks will watch a phenomenon no other shores present.

Tiny cubes and spires will appear upon the horizon. Slowly, they will rise and rise until they tower above the ship in the majestic symmetry of an American skyline.

► As our sons and brothers pour ashore, the post-war world will begin—whether we are ready for it or not.

It behooves us to be ready.

In a war, it's a good rule to produce weapons in fear of defeat, but also to produce peace plans in fear of victory . . . And when we plan for peace, let's see that our "Castles in the air have their feet on the ground."

We know our men will come home to a land of tall buildings, fertile fields and swift transportation. Those things were in being when they went away.

But our post-war world will depend upon how we *use* the tools at hand, not upon the mere fact that we have them.

We *could* embark upon a vast new expansion of industry, based upon new production techniques and the use of light metals, plastics, and electronics.

We *could* foster world-wide trade that would raise the living standard of all peoples to our own level.

If we *could*, why not do it?

► We'll muff the job unless we keep our air castles tied to the ground. We have the ability and the will, but we may not understand how jobs are made and civilization is spread.

If we hold on to the fact that art, science, political experiments, luxuries AND necessities *all* must have their foundations in healthy industry, we will be more careful about doing the things that will keep business healthy.

When we realize that business progress is the foundation of all improvement, our tax laws will stop confusing personal profit (salaries and dividends) with reinvested profit.

► Profit held for reinvestment is the SEED MONEY of business. It is the money a business saves from current operations to insure future growth.

Business will need billions of "Seed Money" dollars when the war is over. But, under the present tax law, they cannot save as they should for that rainy day.

You hear lots of talk about the jobs that will result from the transparent automobiles and the sky-sedans

Air have had their Feet on the Ground

that industry will build after the war, but not enough talk about the need for SEED MONEY to turn those hopes into realities.

The practical fact is that business cannot adjust itself to post-war production without "seed money."

► "Seed money" will pay for the research that must come before new and better post-war products can be built. It will pay for retooling when new models are produced. It will pay for the study of methods to get the lower costs that will make it possible for more people to buy. It will pay for setting up new distributors and dealers, and for hundreds of other activities that are involved in the *growth* of business.

The tax law should be adjusted to allow business to accumulate funds for these necessary tasks of post-war development.

Ask your Congressman to see that American business is given a chance to create jobs after the war, be revising the excess profits tax so as to leave the "seed money."

THE McGRAW-HILL NETWORK OF INDUSTRIAL COMMUNICATION

22 publications, which gather "war-news" from the "war-production-front" through a staff of 153 editors and 725 engineer-correspondents . . . More than 1,500,000 executives, designers, production men and distributors use the editorial and advertising pages of these magazines to exchange ideas on war-production problems.

McGRAW-HILL BOOKS

Publishers of technical, engineering and business books for colleges, schools, and for business and industrial use.

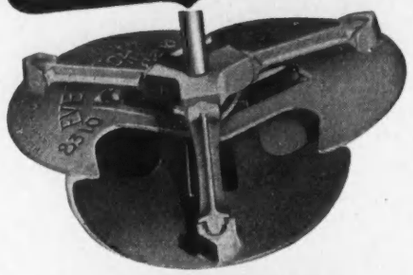
McGRAW-HILL

PUBLISHING COMPANY, INC. . . . 330 WEST 42ND STREET, NEW YORK

THE McGRAW-HILL NETWORK OF INDUSTRIAL COMMUNICATION:

American Machinist • Aviation • Bus Transportation • Business Week • Coal Age • Chemical & Metallurgical Engineering • Construction Methods Electrical Contracting • Electrical Merchandising • Electrical West • Electrical World • Electronics • Engineering & Mining Journal • E. & M. J. Metal and Mineral Markets • Engineering News-Record • Factory Management & Maintenance • Food Industries • Mill Supplies • Power • Product Engineering • Textile World • Wholesaler's Salesman • Affiliated with Business Publishers International Corporation, publishers of business and technical magazines for Latin America, and overseas circulation

EVERSTICK ANCHORS...



FOR SPEED IN INSTALLATION

The exclusive Everstick nut housing locks the Anchor firmly on the rod. This speeds up installation. Plates are so designed, that they expand easily into undisturbed earth, and extra holding power is achieved. Made of tough, rust-resistant malleable iron. Write for bulletin.

EVERSTICK ANCHOR CO.
FAIRFIELD, IOWA

ILSCO
Electrical Connectors

Ilsco APPROVED SINGLE HOLE SOLDERING LUGS

DRAWN DOWN TO SIZE IN OUR OWN PLANT

Ilsco Draws Its Own Copper Tubing

from maximum conductivity SEAMLESS copper tubing assuring you utmost quality.

Wire size stamped on each lug. Tongues have smooth, flat contact surfaces. Barrel ends fit snugly. Can't leak solder.

MAIL THIS COUPON TODAY

Please send details and new 32-page illustrated catalog.

FIRM NAME .....

NAME .....

ADDRESS .....

ILSCO COPPER TUBE & PRODUCTS, Inc.
CINCINNATI, OHIO

Sales Opportunities

ILLINOIS—Moline-Rock Island Mfg. Co., Moline, is arranging fund of about $1,370,000 for expansion and improvements in Illinois and Iowa, including transmission lines, distribution systems, power substations and other facilities.

WISCONSIN—A. O. Smith Corp., 3533 North 27th St., Milwaukee, manufacturer of pressed steel products, plans plant for production for government, comprising several large units, with installation of machinery and electrical equipment for heavy output. Cost over $23,000,000, with financing by Defense Plant Corp., Washington, D. C. Work is scheduled to be carried out at early date.

PENNSYLVANIA — Carnegie-Illinois Steel Corp., Carnegie Building, Pittsburgh, has approved plans for new power substation, with installation of transformers, switchgear and auxiliary equipment. No estimate of cost announced.

CALIFORNIA—War Department has authorized new air force base, comprising hangars, shops, warehouses and other industrial buildings. Electrical equipment will be installed. Also, power substation, with distribution lines for airfield, industrial and residential service. Entire project will cost over $2,000,000 and will be supervised by U. S. District Engineer Office, Sacramento. Work will begin soon.

INDIANA—Continental Roll & Steel Foundry Co., East Chicago, plans expansion in plant for production for government, with installation of machinery and electrical equipment for considerable increased capacity. Cost estimated in excess of $300,000, with financing by Defense Plant Corp.; proposed to proceed with work at early date.

MICHIGAN—Rotary Steel Co., 14300 Mound Road, Detroit, has completed plans for electrical installation in new addition to plant. Giffels & Vallet, Inc., and L. Rossetti, Marquette Building, Detroit, are architects and engineers.

FLORIDA—War Department has authorized large station hospital at air force base, with power station, air-conditioning system and complete electrical equipment. Cost over $1,000,000. Project will be supervised by U. S. District Engineer Office, Jacksonville.

LOUISIANA—U. S. District Engineer Office, Galveston, Tex., will make extensions in airport, including warehouse, motor repair shop, administration building, barracks, mess hall and other structures. Complete electrical equipment will be installed, including exterior lighting facilities, distribution lines, etc. No estimate of cost announced. Work will begin soon.

KANSAS—U. S. District Engineer Office, Davidson Building, Kansas City, Mo., plans complete electrical distribution system at new air force training school, with facilities for light and power service in large group of buildings. General contract for building project has been let to Peter Kiewits Sons Co., Omaha National Bank Building, Omaha, Neb., and it is understood that a sub-contract for work noted will be made through that company. Entire development will cost over $4,000,000.

NEBRASKA—Aviation Field Board, North Platte, Cary W. Dressler, secretary, plans installation of additional lighting facilities at municipal airport. Project has been approved by Nebraska Aeronautical Commission and work will be carried out soon.

WISCONSIN—Briggs & Stratton Corp., 2711 North 13th St., Milwaukee, manufacturer of gasoline engines, automobile equipment, etc., plans expansion in a plant for production for government, with machinery and electrical equipment installation for large increased capacity. Cost estimated over $900,000, with financing by Defense Plant Corp. Proposed to proceed with work at once.

MASSACHUSETTS — War Department has approved plans for expansion in army air base, with additional shops, warehouses and other industrial structures. Electrical equipment will be installed, including additional power substation facilities and distribution lines. Entire project will cost over $1,000,000 and will be supervised by U. S. District Engineer Office, Boston. Program will proceed at early date.

OHIO—U. S. District Engineer Office, Dayton, is completing plans for addition to a steam power plant, with bids scheduled to be asked at early date.

WISCONSIN—War Department has authorized resumption of construction of an army air base, suspended last fall, to include training, administration and housing buildings, totaling over 70 structures in all. Electrical equipment will be installed, with distribution lines for light and power service. Estimated cost not announced. Project will be supervised by U. S. District Engineer Office, Milwaukee, and will begin soon.

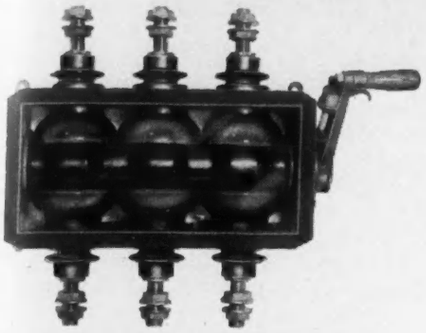
OHIO—Aviation Corp., Williamsport, Pa., manufacturer of aircraft parts, plans expansion in branch plant for production for government, with machinery and electrical equipment installation to double present capacity. Cost estimated over $300,000, with financing by Defense Plant Corp. Work is scheduled to be done at once.

MICHIGAN—Consumers Power Co., Jackson, has contracted with U. S. District Engineer Office, Detroit, for extensions in transmission lines for power service for a government development, including power substation unit and other operating facilities. Entire project is reported to cost in excess of $500,000.

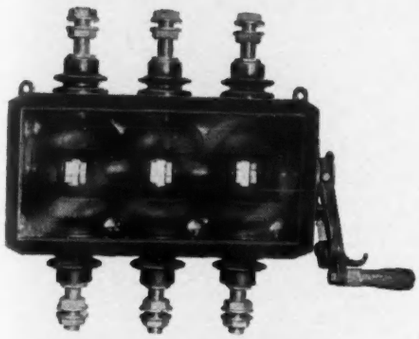
ALABAMA—War Department has authorized new army general hospital, comprising large group of one and multi-story buildings, with power plant, ice and refrigerating plant, air-conditioning system, pumping station and other facilities. Complete electrical equipment will be installed. Entire project will cost over $4,000,000 and will be supervised by U. S. District Engineer Office, Mobile. Work is scheduled to being at early date.

CALIFORNIA—Shell Chemical Co., 100 Bush St., San Francisco, plans expansion in plant for production for government, comprising group of one and multi-story processing and production buildings and auxiliary structures. Considerable machinery and electrical equipment will be installed. Entire program will cost in excess of $5,000,000, with financing by Defense Plant Corp. Project is scheduled to be carried out at once.

ROTA SAFETY SWITCH QUIZ



ROTA SWITCH CLOSED POSITION



ROTA SWITCH OPEN POSITION

ROTA SWITCH WITH MULTIPLE WIRE TERMINATOR ALSO MADE IN SINGLE INDIVIDUAL TERMINATORS

The Questions Most Frequently Asked:

Q: Why is it called a ROTA switch?
A: To open and close switch, the blades rotate.

Q: Why is it called a SAFETY switch?
A: Being glass enclosed, contacts are shielded from operator.

Q: What is the primary purpose of the Rota?
A: To isolate apparatus for inspection and repair.

Q: How heavy a load will it break?
A: It is not made to break a load. It is a safe, practical switch for high voltage motors used in connection with circuit breakers or starters.

Q: For what services is it particularly adapted?
A: In industrial plants for many types of circuits where operators had been accustomed to low voltage circuits only.

Q: Is it made for hand operation only?
A: It is also made for electrical operation.

Q: In what types does it come?
A: The standard types here shown—can also be supplied for double throw operation, selective service—can be electrically or mechanically interlocked with breakers.

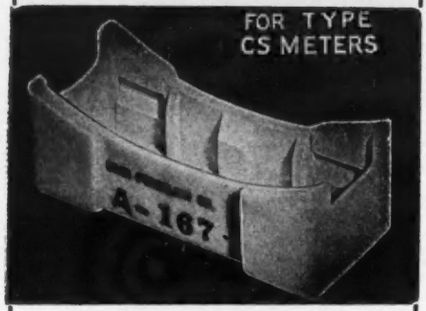
FEATURES:

Dustproof due to glass enclosure
Safe distance from live parts to ground
Prevents operator from contact with live parts
Switch position, visual and indicator
Group operation of phases
Hand or electric operation
Handle, right or left hand
Operated by direct or remote control
Voltages 5 to 15 kv. amperes 200 to 1200
Poles 2, 3, 4, etc.
No live parts exposed in either open or closed position
No barriers required. Easily mounted.

NEW BULLETIN
Write for a Copy

ELECTRIC POWER EQUIPMENT CORPORATION
412 North 18th St. Philadelphia, Pa.

The STAR METER SEAL is made of PORCELAIN



For Type CS Meters

Porcelain is more easily procurable than metal for some purposes. It is a material ideally suited for Meter Seals, since it must be destroyed in order to tamper with the meter. It can be of tremendous value to you.

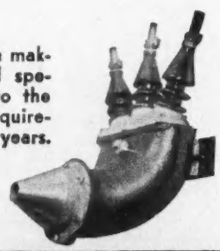
The STAR PORCELAIN COMPANY

51 Muirhead Ave. Trenton, N. J.

ELECTRICAL SPECIALTIES FOR HEAVY DUTY POWER SERVICE

RMC

Rusgreen has been making Potheads and special items, built to the most exacting requirements for many years. Bring your electrical problems to Rusgreen today!



ENDULATORS (POTHEADS) ALL SIZES • ALL SHAPES • ALL VOLTAGES • ALL TYPES • BUS SUPPORTS • SPLICING KITS AND MATERIALS • INSULATING COMPOUNDS

★ ★ ★

RUSGREEN MFG. CO.

14260 Birwood Avenue • Detroit, Mich.

LETTERS TO THE EDITOR

Core Loss Correction Made by Voltmeter

To the Editor of ELECTRICAL WORLD:

We were particularly interested in the articles "Core Loss Correction Made by Voltmeter" and "Correcting Values of Exciting Current," which appeared respectively in the November 14 and November 28 issues of the ELECTRICAL WORLD.

These articles describe the application of the average voltage voltmeter for the reduction of core loss and transformer exciting current to sine wave voltage basis and are based on an article which appeared in the *Electrical News and Engineering* (Canada) for July, 1942.

The average voltage voltmeter and the methods of application to the testing of transformers are not new to American engineers. These were described about fifteen years ago in the following two articles: "A Flux Voltmeter for Magnetic Measurements," by G. Camilli, *Transactions of the A.I.E.E.*, 1926. "Reduction of Transformer Exciting Current to Sine Wave Basis," by G. Camilli, *A.I.E.E. Journal*, 1927.

The use of the average voltage voltmeter was suggested to the A.I.E.E. many years ago and its use was recommended in the A.I.E.E. Standards, No. 13, May, 1930, page 14.

The method of correcting the values of transformer exciting current to sine wave basis, which was described in the November 28 issue of the ELECTRICAL WORLD, is self-evident in the light of past investigations.

With some limitations, the method may yield satisfactory accuracy. It is deduced from ASA Rules C-57, March, 1940, Pars. 10.090 and 10.091, which read as follows:

Par. 10.091—"When using an average-voltage voltmeter and r.m.s. ammeter, the measured r.m.s. value of exciting current will *generally be higher* than that obtained with a sine-wave of voltage, when the voltage wave shape departs appreciably from a sine wave.

Par. 10.090—"Measurements of exciting current are ordinarily made with r.m.s. voltmeter and ammeter. In cases where the voltage-wave shape departs appreciably from a sine wave, as when the transformer is large in rating compared with the generator used for test, the *exciting current will be lower* in value than that obtained with a sine wave of applied voltage."

The ASA rules C-57 therefore recognizes that by setting the voltage by the average voltage the exciting current is higher than the true value, while setting the voltage by the ordinary voltmeter, the exciting current is *lower* than the true value.

Evidently if the two values of the exciting current readings thus obtained do not differ very much (say 10–15 percent) the average value is approximately equal to the exciting current at sine wave voltage.

The decision whether the average value is approximately equal to the true value should be based not on the difference between the readings of the average voltage and r.m.s. voltage, but on the differential between the exciting current values obtained from the two voltage readings.

The differential between the two voltage readings (average voltage and r.m.s. voltage) is not a criterion to base the accuracy of the method, since with the same differential in voltage, the two values of the exciting current obtained will be more widely separated, the higher the core density of the transformer under test.

G. CAMILLI,
Power Transformer Dept.,
General Electric Co.,
Pittsfield, Mass.

•

Substitutes for "Substitute"

To the Editor of ELECTRICAL WORLD:

Your November 14 editorial brings up my good old American hate for the word "ersatz." How do you like the suggestion of "redemption material"? This is certainly not applicable to mahogany dust coffee.

J. C. RUNYON,
Consulting Engineer,
Falls Church, Va.

To the Editor of ELECTRICAL WORLD:

Referring to the desire for a different word than "ersatz" or "substitute," it seems to me that what we are after is a word to designate materials that are designed to help out in the war emergency. This being true, what is more fitting than to call them "warmerge" materials? This is my suggestion.

ELMER SMITH,
District Turbine Specialist,
General Electric Co.,
Boston, Mass.

•

G.E. Stockholders

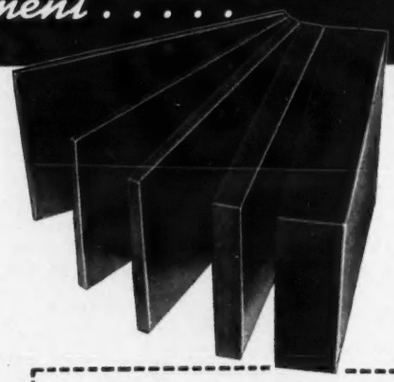
General Electric Co. reports that on December 18 stockholders on record totaled 221,501. This is an increase of 618 since the last record date, September 25, and represents an increase of 3,145 over a year ago.

HIGH DIELECTRIC STRENGTH

LIGNOLITE
A LAMINATED LIGNIN
PLASTIC
FOR ELECTRICAL INSULATION . . . .

Dielectric Strength—Short Time Test Thickness in Inches	
1/16	700-900 volts per mil
1/8	550-700 volts per mil
1/4	500-700 volts per mil
Dielectric Strength—Step by Step Test **Thickness in Inches**	
1/16	450-650 volts per mil
1/8	550-600 volts per mil
1/4	350-500 volts per mil

AN EFFICIENT INSULATION
for many types of Electrical Equipment . . . . .



If you require an immediate source of supply for plastic insulation, investigate LIGNOLITE. This proved, dependable electrical insulating material not only offers permanency but can be standardized upon and included in your long time planning.

LIGNOLITE is available for all applications NOW because NO CRITICAL MATERIALS are used to produce it.

Beside HIGH DIELECTRIC STRENGTH, Lignolite has such important properties as, LOW MOISTURE ABSORPTION (resistant to water, oil, grease, and dilute acids)—ARC RESISTANCE of 183°—188 seconds—and HIGH STRENGTH-WEIGHT RATIO.

LIGNOLITE is easily machined or fabricated and is available in black color, satin or molded sandblast finish. The following sizes are now produced—46-inch x 46-inch and 28-inch x 72-inch sheets in thicknesses from 1/64" to 5/8" inclusive, and 40-inch x 40-inch sheets in thicknesses over 5/8" to 2". Other sizes can be made available and details will be supplied on request.

SUGGESTED USES

● Base plates for mounting electrical equipment—Terminals and Electrical Connections — Switchboards and Panel Boards—Barriers — Spool Heads — Insulating Washers—Linings for Metal-Clad Switchgear Cabinets—Bus Clamps —Cabinets to house electrical equipment — Foundry Pattern Plates — Nameplates — Industrial Work Table Tops—Jigs, Fixtures and Conveyor Guides.

Sample sent Free

A sample of LIGNOLITE will be sent to you so that you can personally test it. WRITE TODAY and also ask for BULLETIN that tells about the properties, characteristics, and methods of fabricating and using LIGNOLITE.

MARATHON CHEMICAL COMPANY
Div. of Marathon Paper Mills Co.
ROTHSCHILD WISCONSIN

PROFESSIONAL SERVICES

BARKER & WHEELER

Utility and Industrial Valuations, Design and Construction of Power Systems, Water Supplies, Sewerage and Sewage Disposal, Factory Production and Cost Control Systems.

11 Park Place, New York City
36 State Street, Albany, N. Y.

ROBERT E. FOLEY CONSTRUCTION CORPORATION

Rural Lines—Transmission Lines
Fire Alarms—Telephone Lines

48 Griswold St. Binghamton, N. Y.

DANIEL W. MEAD
F. W. SCHEIDENHELM

Consulting Engineers
Hydro-Electric Development, Dams, Water Supply, Flood Control. Engineering Problems relating to Water Rights and Water Power Law. Appraisals.
New York City, 50 Church St.

BLACK & VEATCH

Consulting Engineers

Water, Steam and Electric Power Investigations, Design, Supervision of Construction, Valuation, Tests and Laboratory Service.

4706 Broadway, Kansas City, Mo.

FORD, BACON & DAVIS, Inc.

ENGINEERS
DESIGN • CONSTRUCTION
VALUATIONS • REPORTS
New York
Philadelphia — Washington — Cleveland — Chicago

ARTHUR L. MULLERGREN

Engineering-Management
Public Utilities—Natural Gas

Kansas City, Mo.

BROADWAY MAINTENANCE CORPORATION

LIGHT AND POWER DIVISION
Design - Construction - Maintenance
Transmission, Distribution and Rural Electric Lines

47-47 35th Street Long Island City, New York

FRANK F. FOWLE & CO.

Electrical and Mechanical ENGINEERS

35 East Wacker Drive Chicago, Ill.

Recording & Statistical Corp.

BILL ANALYSIS—CONSUMPTION STUDIES
THE ONE-STEP METHOD
Bill Frequency Analyzer

102 Maiden Lane New York

E. J. CHENEY AND CO.

ENGINEERS AND CONSULTANTS

Design, Supervision of Construction
Rehabilitation Engineering, Reports, Studies
Valuations, Economic and Business Surveys

61 Broadway New York

GILBERT ASSOCIATES, INC.

Engineers and Consultants
DESIGN, CONSTRUCT, OPERATE & MAINTAIN INDUSTRIALS AND PUBLIC UTILITIES
Reports • Rates • Labor relations • Safety • Purchasing • Costs • Laboratory

61 Broadway New York Reading, Pa. National Press Bldg. Washington, D. C.

SANDERSON & PORTER

Engineers
for the
FINANCING—REORGANIZATION—DESIGN—CONSTRUCTION—
of
INDUSTRIAL and PUBLIC UTILITIES

Chicago New York San Francisco

COLUMBIA ENGINEERING CORP.

STRUCTURAL, MECHANICAL & ELECTRICAL ENGINEERS
War Plant Design - Supervision of Construction - Engineering Reports

61 Broadway New York, N. Y. 323 Plum Street Cincinnati, Ohio

HENKELS & McCOY

(Electric & Telephone Line Construction Co.)

Wood pole transmission lines
Electric Distribution and maintenance

Philadelphia, Pa.

SARGENT & LUNDY

ENGINEERS

140 South Dearborn St.

Chicago, Ill.

HUGH L. COOPER & CO. INC.

General Hydraulic Engineering, including the design, financing, construction and management of hydro-electric power plants.

30 Rockefeller Plaza New York

HOOSIER ENGINEERING COMPANY

Erecting Engineers
Transmission Lines, Substations

46 So. 5th St., Columbus, Ohio
327 South LaSalle Street, Chicago, Ill.
136 Liberty St., New York

SPOONER & MERRILL, INC.

Consulting Engineers

Design—Supervision of Construction
Reports—Examinations—Valuations

20 North Wacker Drive, Chicago, Illinois

DAY & ZIMMERMANN, INC.

ENGINEERS

Design - Construction - Management
Investigations and Reports

NEW YORK PHILADELPHIA Packard Building CHICAGO

WILLIAM S. LEFFLER

succeeding
CHARLES F. LACOMBE—WILLIAM S. LEFFLER
Engineers — Economists
Public Utility Management Problems
Economic Audits for Selective Load Building
Balanced Domestic Load Development
Cost Analysis—Rate Cases
Noroton, Connecticut

STONE & WEBSTER ENGINEERING CORPORATION

Design and Construction
Reports • Examinations • Appraisals
Consulting Engineering

BOSTON - NEW YORK • CHICAGO • HOUSTON
PITTSBURGH • SAN FRANCISCO • LOS ANGELES

Electrical Testing Laboratories Inc.

WAR WORK TESTS

ELECTRICAL — MECHANICAL — PHYSICAL — CHEMICAL — for compliance with Government Specifications.

Inspection—Analysis—Research—Certification

2 East End Avenue at 79th Street New York

CHAS. T. MAIN, INC.

Engineers

Boston, Mass.

Electric, Steam and Hydraulic Projects. Investigations, Reports, Designs and Appraisals.

WELSBACH ENGINEERING AND MANAGEMENT CORPORATION

Engineering - Electrical Construction - Management - Electric and Gas Street Lighting Maintenance

1500 Walnut Street Philadelphia, Pa.

H. F. FERGUSON

Consulting Electrical Engineer

Rate Investigations and Comparisons
Plant Surveys—Reports

288 Alameda Avenue Youngstown, Ohio

J. H. MANNING & COMPANY

ENGINEERING SERVICES

120 BROADWAY, NEW YORK

THE J. G. WHITE ENGINEERING CORPORATION

Engineers — Constructors

New York, N. Y.

Need for Electrode Conservation Shown

If vital war production is not to be impeded by lack of arc-welding electrodes, utmost co-operation of electrode manufacturers and users to make the most of the electrode being produced is essential, H. O. Westendarp, welding engineer, General Electric Co., recently stated in a talk before the Cleveland section of the American Welding Society.

Mr. Westendarp pointed out that electrode manufacturers are operating around the clock, seven days a week. In addition, bare portions of electrodes have been reduced to a minimum in order to lower stub losses, and development laboratories have improved coatings to bring about reduced spatter loss.

The big job of getting the most out of available electrode, however, he declared, was up to users of arc welding. In this connection, he suggested the following six-point program as a guide: (1) Select largest diameter and greatest length electrode that can be applied successfully; (2) joints to be welded must have good fit-up; (3) use proper amperage for the job—avoid excessive currents and long arcs; (4) don't bend electrodes except where absolutely necessary; (5) produce true fillet welds having equal legs; (6) use each electrode down to point where full coating diameter ends.

•

Electric Items Included in Mexico Trade Pact

The State Department has announced the signing of a reciprocal trade agreement between the United States and Mexico which will become effective January 30, 1943.

Among the concessions granted by Mexico of particular interest to electrical manufacturers are the following:

The existing Mexican duty on electric fans and ventilators weighing up to 20 kilograms each is reduced by 30 percent, and that on electric lamps, lanterns and beacons and on reflectors, shades, and stands therefor, is reduced by 17 percent.

Duties on electric irons, stoves, and dry cells, and on fluorescent lamps, are bound against increase. The duty on automatic household refrigerators weighing up to 200 kilograms each is reduced by 20 percent and that on refrigerators weighing more than 200 kilograms each by 22 percent.

Mexican tariff rates on two general items covering both light and heavy machinery are reduced by 50 percent. The two classifications cover important types of machinery for use in mines, quarries, oil wells and refineries, and sugar refineries.

•

Set Quarterly Refrigeration Production

First-quarter production of domestic, non-mechanical refrigerators has been set at 150,000 units. The two allowable models, of 50 and 75 pounds ice capacity respectively, will be used to fulfill military, war housing and essential civilian requirements.

The "Victory ice box" is limited to six pounds of steel per unit and will save 90 percent of the steel used in pre-war refrigerators.

•

Plans New Welding Films

Joe McGee, the Welder, the cartoon personality introduced last summer in General Electric Co.'s popular industrial training films, "The Inside of Arc Welding," will play a return engagement in the spring in a new series of training motion pictures on welding, "The Inside of Atomic Hydrogen Welding," which is now in preparation at the Raphael G. Wolff Studios in Hollywood under General Electric sponsorship. It is expected the new picture will be available about March 15.

•

Starts War Movie

Filming of a documentary motion picture showing how Westinghouse is producing implements of war has begun at the Westinghouse Electric Elevator Co., Jersey City, N. J. The film, entitled "We Shall Win," is being made with the sanction of Army and Navy authorities. After completion of shooting at the Elevator company, manufacture of vital war weapons at other Westinghouse plants will be photographed. The film is expected to be completed in the spring.

•

Ban Recognition of P.G.&E. Employee Unions

Recognition of two independent employee unions must be withdrawn by Pacific Gas & Electric Co. according to an order issued by the NLRB on January 5 in Washington. The two are the California Gas and Electric Employees Union, which was dissolved some months ago, and the Western Utility Employees' Union, representing workers in the San Joaquin Power division of the company. The latter group has

STURD-E GUARDED
PIKE POLE
● The automatic guard adds immeasurably to the safety of this pole—the point is covered when not in use—completely guarded against damage. When in use, the tubular sleeve slides back and reenforces the head, adding to the service life of the pole.
The spike is forged from best quality steel, heat treated and tempered for long life. Handles are select fir—sanded and lacquered—lengths regularly furnished ten to twenty feet. For maximum service life, economy, and value, specify
STURD E TOOLS
a TRUE TEMPER PRODUCT
Automatic Tubular Pike Pole guard is shown in the phantom view above. Extremely simple in operation, it gives positive protection to the point of the pike.
Distributed by
JOSLYN MFG. & SUPPLY COMPANY
Executive Offices
20 North Wacker Drive • Chicago, Illinois
Branches and Warehouses with Complete Stocks in Principal Cities of the United States

opposed the NLRB action, which resulted from charges filed by the IBEW, and has announced that it will carry the case into the federal courts.

•

Recent Legislation Introduced in N. Y.

A number of new bills have been introduced in the legislature at Albany, N. Y., affecting the electric light and power industry.

Daniel Gutman, Democrat, has introduced in the Senate a bill amending paragraphs 614, 639 and adding new paragraph 612 to the conservation law, to declare state to hold ownership of and title to waters and water power as trustee for benefit of all the people and authorizes water power and control commission to fix rental for any and all diversion of water from any navigable stream or river. Referred to conservation committee. (This measure was also advocated by Governor Dewey in his annual message.) Senator Gutman also introduced an addition to Article 14 of the State Constitution to declare water power of St. Lawrence and Niagara Rivers shall remain inalienable and that ownership, possession and control shall always be vested in the people of the state; empowers state to issue license for use of water in connection with waterpower sites for not more than 25 years at equitable rental. The measure was referred to the judiciary committee. An amendment to the public service law introduced by Senator Gutman provides that the public service commission may prescribe rules requiring that gas and electric corporations filing optional rate schedules shall give written notice to consumer once in each calendar year, of lowest rate or form of rate available for future service of consumer, based on use in preceding twelve months. Referred to public service committee. Another amendment to the public service law by Senator Gutman defines gas and electric sub-metering corporations, provides for regulation thereof by public service commission and requires that other business of operator be kept separate. Referred to public service committee.

Another addition to the public service law, introduced by Senator William Kirnan, would authorize public service commission to prescribe uniform methods of measuring and accounting for depreciation of property to be observed by public utility companies and municipalities under its jurisdiction and to fix rates of depreciation and amounts necessary for depreciation reserves. Referred to public service committee.

A new bill (Senator Elmer F. Quinn) provides for establishment by cities of local power authority for furnishing public utility service and for issue of bonds to mature in period not exceeding 40 years; bonds are legal investments for fiduciaries and city is not to be liable on bonds. Referred to cities committee.

Another measure (Senator Quinn) amends paragraph 20 of the general city law to empower a city to issue obligations to which it has not pledged its faith and credit for the payment of principal and interest thereon in connection with construction, leasing, acquisition and operation of any public utility service. Referred to cities committee.

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT : "OPPORTUNITIES" : EQUIPMENT
BUSINESS : : USED OR RESALE

UNDISPLAYED —RATES— DISPLAYED

10 CENTS A WORD. MINIMUM CHARGE $2.00
Positions Wanted (full or part time salaried employment only), ½ the above rates payable in advance.
Box Numbers—Care of publication New York, Chicago or San Francisco offices count as 10 words.
Discount of 10% if full payment is made in advance for 4 consecutive insertions.

Individual Spaces with border rules for prominent display of advertisements.
The advertising rate is $7.25 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.
An advertising inch is measured ⅞" vertically on one column, 3 columns—30 inches—to a page.

NEW ADVERTISEMENTS received by 10 A. M. Monday will appear in Saturday's issue, subject to limitations of space available.

WANTED

HIGH GRADE ELECTRICAL MAN

Must be thoroughly familiar with all types of electric motors, starters, controls, etc. Need not be graduate engineer, but must have proven sales and executive ability. Please give complete details in first letter.

Permanent position at substantial salary to right man. Please do not answer unless you meet fully the requirements outlined.

P-500, Electrical World,
520 North Michigan Ave.,
Chicago, Ill.

POSITION VACANT

TROUBLE SHOOTERS, Armature and Stator Winders, are offered permanent position with one of New England's largest and most successful independent repair shops engaged in defense work. Only men of good character, long experience, and exceptional ability capable of rapid development to positions of responsibility will be considered. Our employees know of this advertisement. All applications will be treated as confidential. P-333, Electrical World, 330 W. 42nd St., New York, N. Y.

EMPLOYMENT SERVICE

SALARIED POSITIONS — $2,500 to $25,000. This advertising service of 33 years' recognized standing negotiates for positions of calibre indicated. Procedure individualized to your personal requirements. Retaining fee protected by refund provision. Identity covered. If salary has been $2,500 or more send for details. R. W. Bixby, Inc., 262 Delward Bldg., Buffalo, N. Y.

EXECUTIVE AND TECHNICAL MEN. Qualified candidates desiring $2,500 to $20,000 position may contact employers through our confidential services, established 27 years. The National Business Bourse, 20 W. Jackson Blvd., Chicago.

POSITIONS WANTED

POSITION as superintendent of municipal utilities, twenty years experience with steam and diesel generating equipment and distribution systems. PW-331, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

ELECTRICAL AND STRUCTURAL ENGINEERS, experienced power house, substation, and transmission line designers, immediately available. Public utility engineers completing authorized construction projects will gladly arrange interviews and otherwise bring your requirements to such men's attention. PW-501, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

ELECTRIC MOTOR repairman available on, AC-DC motors and electrical apparatus with twenty-five years experience on all kinds of rewinds and change overs. PW-502, Electrical World, 330 W. 42nd St., New York, N. Y.

MANUFACTURING PLANT-TRANSFORMERS Cleveland area, sales, $10,000 month; complete personnel; opportunity to expand; health compels immediate sale. APPLE COMPANY Brokers CLEVELAND, OHIO.

POSITIONS WANTED

TECHNICALLY TRAINED electrical engineer. Experience in operation, construction, design, maintenance, and research. Five years in charge of specialized electrical oil field service equipment and personnel. Testing engineer for complete electrical equipment. Married. One child. Will go anywhere. Desire permanent location. PW-503, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

ELECTRICAL ENGINEER (1938 Pratt Graduate) available now for essential war industry located within Metropolitan New York commuting area, on field research; product development; liaison; or as expeditor etc. Experience includes 5½ years technical writing, reporting; photography for electrical trade paper. Age 28; married; 1 child. U. S. citizen. 3A. PW-505, Electrical World, 330 W. 42nd St., New York, N. Y.

SELLING OPPORTUNITIES
OFFERED—WANTED
Selling Agencies—Sales Executives
Salesmen—Additional Lines

OPPORTUNITY OFFERED

MANUFACTURERS' REPRESENTATIVES (Four Engineering Salesmen) selling transformers and safety switches in Chicago and mid-western states, desire kindred lines. Own Warehouse facilities. RA-93, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

WORK WANTED

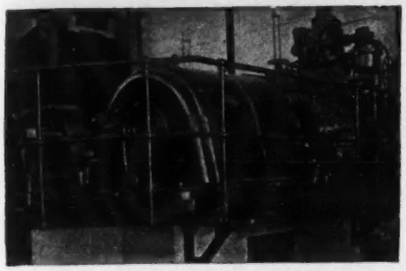
MANUFACTURERS AGENTS well established in Chicago territory with warehousing and engineering facilities, desires additional lines. WW-504, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

SALESMEN WANTED

THERE is an opening in a few selected territories for an experienced salesman who has successfully sold services or intangibles. Technical experience not necessary. An American Citizen between the ages of 35 and 55, preferably married, who is able to meet and contact key executives in industry. Field training will be given the successful applicant and earnings should be $4,000 a year—the average of our present salesmen. One acquainted with the field served by this publication will find this connection a pleasant and profitable one. Our organization is an old, well-known concern with an excellent reputation. To learn more about this opportunity write full details to

SW-506, Electrical World
330 West 42nd St., New York City

FIRST AID TO THE PLANT THAT NEEDS POWER FOR PRODUCTION!



MOTORS—D. C. 230 VOLTS

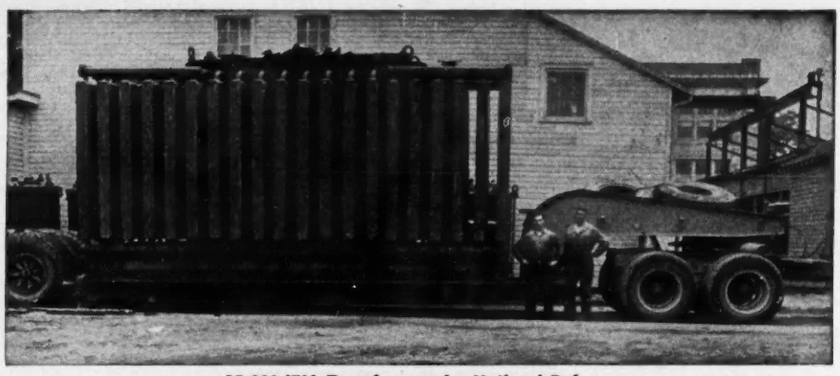
1—250 HP, 760 RPM, Electro Dynamic.
1—150 HP, 750 RPM, Electro Dynamic.
1—125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, G.E. 575 RPM.
1—100 HP, 625 RPM, G.E.
1—90 HP, 900 RPM, G.E.
1—75 HP, 950 RPM, G.E.
1—65 HP, 1000 RPM, G.E., type RC.
1—50 HP, 750 RPM, Westinghouse, type SK.
1—50 HP, 700 RPM, Crocker Wheeler.
1—40 HP, 775 RPM, Westinghouse.
1—40 HP, 800 RPM, General Electric.
1—30 HP, 750 RPM, G.E., type RC.

MOTORS—VARIABLE SPEED 230 VOLTS

2—100 HP, 475/1375 RPM, Electro Dynamic.
1—90 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electro Dynamic.
1—60 HP, 600/1200 RPM, General Electric.
1—35 HP, 500/1500 RPM, Westinghouse.
1—35 HP, 350/1050 RPM, Electro Dynamic.
1—30 HP, 225/900 RPM, Crocker Wheeler.
2—25 HP, 300/900 RPM, Electro Dynamic.
1—20 HP, 750/1500 RPM, General Electric.
1—15 HP, 300/1200 RPM, G.E.
1—13/18 HP, 350/1200 RPM, Electro Dynamic.
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP, 450/1800 RPM, Crocker Wheeler.
1—5 HP, 400/1600 RPM, Diehl.
1—5 HP, 225/900 RPM, Electro Dynamic.

MOTORS GENERATOR SETS

1—20 KW, 600 volt, GE, sq. cg.
2—250 KW, 250 v., GE Synch.
2—200 KW, 125 v., Wsgh., Sq. Cage
1—100 KW, 125 v., GE Sq. Cage
1—50 KW, 250 v., Wsgh., Sq. Cage



15,000 KVA Transformers for National Defense

ALTERNATORS

1—625 KVA, 3600 RPM, 600 volt, G.E.
1—400 KVA, 400 RPM, 240 volt, Westg.
1—250 KVA, 720 RPM, 230 volt, G.E.
1—200 KVA, 3600 RPM, 240 volt, Allis Chal.
1—62½ KVA, 3600 RPM, 220 volt, Allis Chalmers.

TURBO-GENERATORS

600 KW Terry dual bleeder condensing Turbine only.
1—500K W, G.E., 3 ph., 60 cy., 480 volt, bleeder.
1—375 KVA, Westinghouse, non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 volt, cond.
1—200 KW, G.E., 3 ph., 60 cy., 220 volt, cond.

MOTORS—3 PHASE 60 CYCLE

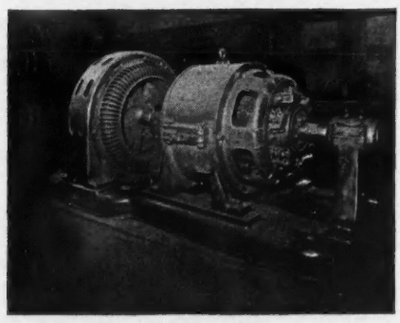
1—720 HP, 360 RPM, 440 volt, G.E., syn.
1—500 HP, 1200 RPM, 440 volt, GE, syn.
1—400 HP, 514 RPM, 440 volt, Westg., slip ring.
1—335 HP, 600 RPM, 2300 volt, GE, syn.
1—300 HP, 720 RPM, 2200 volt, G.E., Sl. Rg.
1—250 HP, 514 RPM, 4000 volt, G.E., syn.
1—250 HP, 600 RPM, 4000 volt, G.E. Sync.
1—200 HP, 900 RPM, 440 volt, Westg., sl. rg.
1—200 HP, 600 RPM, 2200 volt, G.E., sl. rg.
1—200 HP, 450 RPM, 2200/4000 v., G.E., sl. rg.
1—150 HP, 1800 RPM, 2300 volt, Al. Ch. sq. cg.
1—150 HP, 900 RPM, 440 volt, Al. Ch. sl. rg.
1—150 HP, 720 RPM, 440 volt, G.E., slip ring.
1—150 HP, 600 RPM, 440 volt, G.E., slip ring.
1—150 HP, 400 RPM, 440 volt, G.E., sq. cg.
2—125 HP, 720 RPM, 440 volt, G.E., slip ring.
1—100 HP, 900 RPM, 440, Westinghouse, sq. cg.
1—100 HP, 900 RPM, 440 volt, G.E., slip ring.
3—100 HP, 720 RPM, 440 volt, G.E., slip ring.
1—100 HP, 720 RPM, 440 volt, G.E., sq. cg.
1—100 HP, 600 RPM, 440 volt, G.E., slip ring.
1—100 HP, 600 RPM, 440 volt, G.E., sq. cg.
1—100 HP, 514 RPM., 440 volt, G.E., sq. cg.
2—100 HP, 450 RPM, 440 volt, G.E., sq. cg.
1—90 HP, 400 RPM, 550 volt, Cr. Whlr, sq. cg.
1—75 HP, 900 RPM, 4000 volt, Elec. Mach. syn.
1—75 HP, 900 RPM, 220 volt, Fairbanks, Morse, slip ring.
1—75 HP, 900 RPM, 440 volt, GE, sq. cg.
1—75 HP, 720 RPM, 440 volt, Westghse, slip ring.
1—75 HP, 720 RPM, 440 volt, GE, sq. cg.
1—50 HP, 900 RPM, 440 volt, GE, slip ring.
1—50 HP, 900 RPM, 440 volt, GE, sg. cg.

TRANSFORMERS

2—400 KVA, G.E., 4156-240/480 v., Scott taps.
3—300 KVA, Pittsburgh, 7800/440 volts.
3—250 KVA, Westinghouse, 5500/440 volts.
2—200 KVA, GE, 2300/4600-230/460 volts, Scott taps.
1—200 KVA, Pittsburgh, 7800-110/220 volts.
3—150 KVA, G.E., 33,000 2300/4000 Y.
1—150 KVA, G.E., 2400-120/240 volts.
3—100 KVA, Westinghouse, 11,430/250 volts.
1—100 KVA, Pittsburgh, 1375/2750-110/220 volts.
1—100 KVA, G.E., 2200-110/220 volts.
3—100 KVA, Westinghouse, 13200 250 volts.
3—75 KVA, G.E., 13.500-7500/440 volts.
1—75 KVA, G.E., 3 phase, 4156Y-120/208Y.
1—75 KVA, Pittsburgh, 7600-110/220 volts.
3—50 KVA, Wagner, 4150-220 volts.
2—50 KVA, Pbgh. 7500/15,000 volts-110/220 volts.
4—37½ KVA, 2200-220/110 v.
7—25 KVA, Westg., air cooled, 440/220-110 v.
1—25 KVA, G.E., 220/110-220/110 volts.
2—15 KVA, G.E., 2300-115/230 volts.
4—10 KVA, G.E., 2300-115/230 volts.
3—7½ KVA, G.E., 440-110/220 volts.

OIL CIRCUIT BREAKERS

1—3000 amp., 15,000 v., 3 pole, G.E., type FK-130.
1—3000 amp., 600 v., 4 pole, G.E., type FK-24.
1—1600 amp., 7500 v., 4 pole, Westg., B-2.
1—1200 amp., 15000 v., 4 pole, Westg., B-2.
Also complete stock of small sizes.



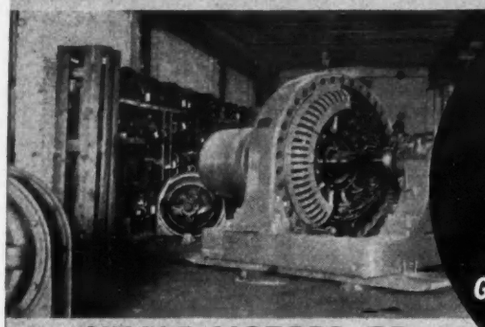
POWER EQUIPMENT FOR FIGHTING EQUIPMENT

HEMPHILL

J L HEMPHILL & CO..1602 53rd ST NORTH BERGEN N.J.

★ ★ *Phone* New York — Longacre 5-3227 New Jersey — Union 3-2600 ★ ★

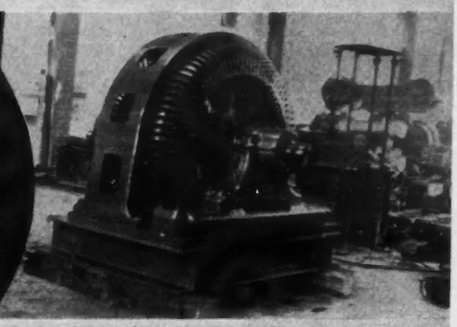
IMMEDIATE ANSWER TO YOUR POWER EQUIPMENT NEEDS



CHICAGO ELECTRIC *Rebuilding*

GIVES YOU DEPENDABLE GUARANTEED UNITS . . . .

☆ ☆ ☆



SINGLE MOTORS OR COMPLETE POWER PLANTS

COMPANY

Make Chicago Electric your headquarters for power equipment units—get the benefit of an experienced organization whose service is most valuable now when dependable power units are so important in the victory effort.

Every unit undergoes a complete remanufacturing job from one end to the other. We re-build to give you equipment that will stay in service and assure the utmost in trouble-free performance.

Even though we are rushed every minute now, we maintain our high manufacturing standards in engineering and manufacturing.

Our large facilities and experienced personnel are at your service.

A Few Units from our Huge Stocks

MOTOR—GENERATOR SETS

800 KW	Elliott	250 v DC 440 v. syn.
300 KW	Westg.	250 v DC 2200 v. syn.
235 KW	Westg.	115 v DC 2200 v. syn.
225 KW	Ideal	115 v DC 2200 v. syn.
150 KW	Ideal	250 v DC 440 v. syn.
100 KW	G.E.	3-wire, 2200/440. Ind.
100 KW	Al. Ch.	3-W 4000/2200 Ind.
100 KW	G.E.	250 v. 2200 v. Ind.
100 KW	Wtg.	125 v. DC 2200 v. Ind.
100 KW	Al.Ch.	125 v DC 440 v. syn.
75 KW	G.E. (2)	125 v DC 3/25/220 AC.
75 KW	G.E.	125 v DC 220 v. syn.
75 KW	G.E.	250 v DC 440 v. Ind.
75 KW	G.E.	250 v DC 2200 v. syn.
90 HP	Wtg.	110 v.DC 75 KVA 2200 v.
70 KW	G.E.	125 v DC 220 v. syn.
50 KW	Al.Ch.	115 v DC 2200 v. Ind.
50 KW	Al.Ch.	125 v DC 2300/440 Ind.
50 KW	G.E.	125 v DC 4000/2200 Ind.
33 KW	G.E.	110 v DC 2200 v. syn.
22½ KW	G.E.	125 v DC 220/440 Ind.
15 KW	Ideal	240 v DC 220 v. Ind.
15 KW	G.E.	220 v DC 220 v. Ind.

SLIPRING

HP	Make	Type	Volts	Speed
2850	HP Wtg.	CW	6600	253
1500	HP Al. Ch.	ANY	2300	485
800	HP Wtg.	CW	6600	443
600	G.E. (2)	I-M	2200	1770
500	G.E. (2)	I-M	2200	600
350	G.E.	MT	2300	300
350	Al. Ch.		2200	300
300	G.E.	I-M	240	293
300	G.E.	I-M	2200	514
225	G.E.	I-M	220	600
200	Wtg.	CW	440	870
200	Howell Rl. brg.		440	600
200	G.E.	I-P	440	1170
200	Wtg.	CW	440	345
200	G.E.	I-L	2200	585
200	Wtg.	CW	440	580
150	Wagner	BR	440	1140
150	G.E.	MT	440	875
150	Wtg.		440	600
150	Wtg.	CW	440	575
150	G.E.	I-M	220	600
150	G.E.	I-M	220	585
125	Wtg.	CW	2300	1750
100	G.E.	I-M	2300	600
100	West.	CW	440	575
100	G.E.	I-M	220	570
75	Northwest.	HW-50	220	1740
75	Allis Chal.	ARY	220	1160
75	Wtg.	CW	440	1160
75	G.E.	MT	440	1200
75	Allis Chal.	ARY	220	865
75	Cr. Wheeler	24Q	220	720
75	Allis Chal.		2200	690
75	Westg.	F	440	690

SYNCHRONOUS

750	Westg. (2)		4000/2200	1200
650	Al. Chal.		2200	1200
270	G.E.	ATI	2300	600
200	Wtg.	HR	2200	225
190	El. Machy.		440	720
5000	G.E.		2300	82 RPM
2100	G.E.	ATI	4600/2300	514 RPM
800	Al. Ch.		2200	900 RPM
800	El. Machy.		6600	450 RPM

TRANSFORMERS

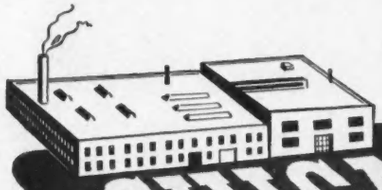
Kva	Qu.	Make	Type	Pri	Sec
150	2	Wtg.	SK	2300/115	480/240
125	1	Kuhlman		2300	125
100	1	G.E. (25cy)	HT	9000Y	230
100	2	G.E.	H	4000/2300	110/220
75	3	Wtg.	S	3810	244/122
75	6	Wtg.	SK	3810	240/122
20	1	Moloney	HE	440	120/240
20	3	Moloney	HE	1150/2300	230/460
7½	1	G.E. 3 ph.	HT	6600Y	230
7½	1	G.E. 3 ph.	HT	2300	230/460
7½	1	G.E.	H	1100/2200	244/488
7½	1	Pitts.	HE	2200	244/488
7	1	Kuhlman air cld.		460	1/1.5/2

SQUIRREL CAGE

HP	Make	Type	Volts	Speed
200	G.E.	KTF-557	2200	1800
250	Ideal	A	440	1150
200	G.E.	I-K	440	1200
200	Wtg.	CS	440	580
200	G.E.	I-K	440	580
150	Wtg. (2)	CCL	440	495
150	Al. Ch.		440	1170
100	G.E.	KT-356Y	440	900
75	Al. Ch.		440	865
75	G.E.	I-K	220	695
75	G.E.	I-K (5)	220	570
60	Wtg. bb	CS Vert. (4)	2200	1750
60	Wtg.	CS	220	435
50	Watson	KH	440	1720
50	Wtg.	CS	440	1160

Frequency Changer

1400 HP 460 volts, 3 phase, 60 cycle, 300 RPM, 1500 amps. 1250 KVA power factor .9 50-deg. rise, type ATI-24. 1250-M-300 Form C, with synchronous winding. field amps. 102, 1200 KW, 460 volts, 3 phase, 25 cycle, 300 RPM, 1570 amps. 1250 KVA power factor .8 50-deg. rise type ATI-10-1200-M-300 form C, synchronous winding, field amps. 121, With direct-connected exciter.



CHICAGO ELECTRIC CO.

1318 WEST 22nd STREET ★ CHICAGO, ILLINOIS

GENERATORS
AC & DC MOTORS
AIR COMPRESSORS

MOTOR GENERATORS
SWITCHBOARDS
TURBO-GENERATORS

PLATING GENERATORS
WELDING GENERATORS
TRANSFORMERS

REPAIRING
REWINDING
RENTAL

RE-NU-BILT BY BELYEA...

MOTOR GENERATOR SETS

3 phase—60 cycle

1—1500 KW G.E. 600 V. Gen. d.c. to 2100 HP 6600 V. Syn.
1—500 KW Whse. 250 V. Gen. d.c. to 700 HP 2300 V. Syn.
1—500 KW Whse. 250 V. Gen. to 700 KVA, 6600 V. Syn.
1—500 KW G.E. 600 V. Gen. to 700 HP, 2300 V. Syn.
1—150 KW G.E. 250 V. Gen. to 200 KVA, 440 V. Syn.
1—500 KW G.E. 600 V. Gen. d.c. to 700 HP 13200 V. Syn.
1—500 KW G.E. 600 V. Gen. to 700 HP, 2300 V. Syn.
1—150 KW G.E. 550 V. Gen. d.c. to 225 HP 2300 V. Syn.
1—150 KW G.E. 250 V. Gen. to 200 KVA, 440 V. Syn.
1—125 KW Whse. 250 V. Gen. to 200 HP., 440 V. Sq. Cage.
1—100 KW Whse. 250 V. Gen. to 150 KVA, 2300 V. Syn.
1—75 KW G.E. 125 V. Gen. to 125 HP. 2300/4000 V. Sq. Cage.
2—50 KW G.E. 125 V. Gen. to 75 H.P. 2300/4000 V. Sq. Cage.

D. C. MOTORS

HP	Make	Type	Volts	Speed
1—1500	Whse.		550	330
2—1250	G.E.	MPC	500	130
1— 800	G.E.	MPC	550	660
2— 625	G.E.	MPC	250	130
1— 600	G.E.	MPC	550	600/800
1— 600	Whse.		230	150/275
1— 350	G.E.	MPC	230	450
1— 300	G.E.	MPC	230	275/550
1— 300	G.E.	MCF	230	400/1000
1— 300	G.E.	MPC	230	250/400
2— 200	Whse.		230	400/500
7— 175	Whse.	SK	250	150/525
2— 150	Whse.	SK	230	300/900
2— 125	G.E.	CO1832	230	625
3— 100	G.E.	LC	230	1200
1— 100	Whse.	SK	230	600
1— 100	Al. Ch.		230	950/1150

A. C. MOTORS

60 cycle

SLIP RING

HP	Make	Type	Volts	Speed
2—1200	Cr.Wh.	801Q	2300	237
1— 800	Al.Ch.	ANY	440	885
1— 600	G.E.	IM	2200	900
1— 500	G.E.	I-M	440	400
1— 450	Whse.	HW	2200	875
1— 400	Al.Ch.	ANY	440	1200
1— 400	G.E.	MT	550/440	300
1— 400	Al. Ch.	ANY	2300	505
1— 350	G.E.	MT-442	2300/4000	257
1— 300	G.E.	I-M	440	720
1— 300	Whse.	CW	2300	620
1— 250	G.E.	MR	2300	390
1— 350	G.E.	MT	400/2300	251
1— 250	G.E.	MT-410	2300	390
2— 200	Whse.	CW	2200	514
2— 200	G.E.	IT-M	2200	1750
2— 175	G.E.	IE-15A	2200	880

SQUIRREL CAGE

HP	Make	Type	Volts	Speed
1—500	G.E.	1-17B	2200	690
1—400	Whse.	CS	2200	585
1—300	Whse.	CS	550	580
1—300	G.E.	IK	440/2300	600
1—250	Al.Ch.		220/440	1150
1—200	G.E.	IK	2200	490
1—200	Whse.	CS	4600	900
2—200	Whse.	CS	2300	1200
1—200	Whse.	CS	440	580
1—150	Al.Ch.	AN	220/440	1750

ROTARY CONVERTERS

60 cycle

1—1500 KW Whse. 720 RPM 650 V. D.C. with transformers 11500 V. and panels.
1—1250 KW G.E. 720 RPM 250 V. D.C. with transformers 2300 V. and panels.
2—1000 KW, Whse., 900 RPM, 600 V. D.C. with transformers 2200 V. and panels.
1—750 KW, Whse. 900 RPM, 250 V., D.C., with transf. 11,500/6600/2300 V.
2—750 KW Whse. 1200 RPM 600 V. D.C. with transformers 2300/6600 V. and panels.
1—500 KW, Whse, 900 RPM, 250 V., D.C., with transf. 13,200/6600/2300 V.
3—375 KW, Whse., 1200 RPM, 250 V. D.C., with transf., 2300 V.

25 cycle

3—1500 KW G.E. 500 RPM 225/275 V. D.C. Booster type with 13,200/6600 V. transformers and panels. **Actual photo** of one at right side center cut.
1—500 KW G.E. 750 RPM 225/275 D.C. Booster type with 6600 transformers and panels.

TURBO GENERATOR SETS

1—500 KW Whse. 625 Kva. 440 V. 3 ph. 60 cy. 3600 RPM with Parsons 145/175 lb. condensing turbine complete with jet condenser and accessories.

1—500 KW G.E. 625 Kva 2300 V. 3 ph. 60 cy. with denser and accessories.

1—75 KW Ridgeway 250 V. D.C. with Terry turbine 180 lb. pressure with 12 lb. back pressure, 2000 RPM.

TRANSFORMERS

60 cycle

KVA	Make	Ph.	Type	Voltages
1—1500	Whse.	3	OISC	26400/13200/4400
3—1000	G.E.	1	HKDD	13200x2300
3— 300	Pitts.	1	OISC	2300x115/230
2— 333	Pitts.		I-OISE	2400x240
1— 300	Pitts.		3-ODSE	4150x280/120
1— 300	Pitts.		C-ODSE	3150x280/120
3— 300	G.E.	1	H	13200x2300/575
3— 250	Maloney		IC	13800x220/440
2— 200	G.E.		I-HKVD	13800x200/440
3— 150	Whse.		ISK	2200x440/220
3— 200	G.E.	1	HLLD	26400x115/460
3— 150	Whse.	1	SKM	2400x120/240
1— 150	G.E.	3	HT	2300x4000/115
2— 100	Whse.	1	OISC	13200x250
4— 75	Pitts.	1	OISC	2300x575

BELYEA COMPANY, INC.

Main Office and Shop

51 HOWELL ST., JERSEY CITY, N.J.

CHECK OUR STOCK!

TRANSFORMERS
MOTORS
AC-DC—25 and 60 cy.

SPECIALS

1—300 HP. Gen. Elect. Slip-Ring Motor, 3/60/2200 V. 1200 RPM.

1150 HP. G. E. Synchronous Motor 25/3/2200/375.

GENERATOR SETS
FREQUENCY CHANGERS
GENERATORS

SPECIALS

1—100 KW Motor Generator Set, Generator 220 V DC. Motor 3/25/2200 V.

ERIE ELECTRIC COMPANY
124 Church St., Buffalo, N.Y.

Power Equipment

Released by Utilities & Industrials

Turbines, Generators, Steam and Oil Engines, Boilers, Motor Generators, Rotaries, Transformers, Motors, Compressors, etc.

Service backed by 38 years' experience

BREW, WOLTMAN & CO.
30 Church St., New York

3000 KW and 4000 KW-7500

TURBOS

4100V and 480V, 60 cy., 3 ph.

3—100 KW. 125-250 V. NON COND. TURBOS

1500 CFM. compressor MTR. Dr.

4—cent. pumps—4166 GPM.—162' Head

ROSS POWER EQUIP. CO.
Indianapolis, Ind.

WE BUY AND SELL
MOTORS
TRANSFORMERS
MOTOR GEN. SETS
OIL SWITCHES
AIR CIRCUIT BREAKERS

ELECTRIC EQUIPMENT CO.
678 Lake Ave., Rochester, N. Y.
Tel: Glenwood 6783

FOR SALE

1—10-Ton Double I-Beam hand Power Traveling Crane. 48' span, 100' of Runway.

Light and Power Dept., Town House
Town of Hudson, Mass.

Watch—

the *Searchlight Section*
for
Equipment Opportunities

40 KW G.E. Type MP 110 V D.C., belt drive 860 RPM, Form "H", 360 amps
200 KW West. No. 201 SK comp. wound, 600 V D.C. with 290 HP syn. motor, 3/60/2200 and 900 RPM
200 KW Buckeye Diesel Engine & Generator 3/60/240
500 KW Terry Steam Turbine Generator 3/60/240 with barometric condenser
1000 KW G.E. Type ATB-2-1250-3600, Form T, 814 amps. 3/60/2200-900 RPM
5000 KW Turbo & Generator, 3/60/2300
HOIST MOTORS, 2, 50 HP. Ft. Wayne Elec. Co. Type "K", 600 RPM, 220 V D.C.
A.C. Motors: 30 units from 15 to 75 H.P., squirrel cage, 3/60/440
D.C. Motors: 15 units from 3 to 60 H.P. 230 V D.C.

OTHER MISCELLANEOUS ELECTRICAL ITEMS TOO.

Write for our complete list!

IRON & STEEL PRODUCTS, INC.
13438 S. Brainard Ave., Chicago, Illinois.
38 years' experience
***"Anything* containing IRON or STEEL"**

WANTED

—TRANSFORMERS—

TRANSFORMERS WANTED

in operating condition or burnt out. Mail us list giving complete nameplate data and stating condition.

We Rewind, Repair and Redesign all Makes and Sizes
ALL TRANSFORMERS GUARANTEED FOR ONE YEAR
Prices quoted on request.

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M Since 1912 CINCINNATI, OHIO

Quick ANSWERS to your business problems . . .

MISCELLANEOUS business problems are daily being solved, quickly and easily, by the use of the Searchlight Section of this and other McGraw-Hill publications. The Searchlight Section is classified advertising; you can use it at small cost, to announce all kinds of business wants of interest to other men in the fields served by these publications. It has long been the accepted meeting place of men with business needs and the men who can fill those needs.

When you want additional employees or a position, want to buy or sell used or surplus new equipment, want products to manufacture, seek new capital or factory sites or have other business wants—advertise them in the Searchlight Section for quick, profitable results!

Departmental Staff

McGRAW-HILL PUBLISHING CO., Inc.
330 West 42nd Street • New York City

SEARCHLIGHT
(Classified Advertising)
SECTIONS
are found in these
McGRAW-HILL
Publications:

American Machinist
Aviation
Business Week
Bus Transportation
Chemical & Metallurgical Engineering
Coal Age
Construction Methods
Electrical Contracting
Electrical Merchandising
Electrical World
Electronics
Engineering & Mining Journal
Engineering News-Record
E. & M. J. Markets
Factory Management & Maintenance
Food Industries
Power
Product Engineering
Textile World

HALF A CENTURY OF SERVICE

Constantly throughout the years Gregory Electric has been noted for its ability to render prompt and effective service to industrials everywhere. Today, with a fifty-year background of experience Gregory Electric is even better qualified than ever before. For HI-GRADE REBUILT electrical equipment, call Gregory first.

TRANSFORMERS

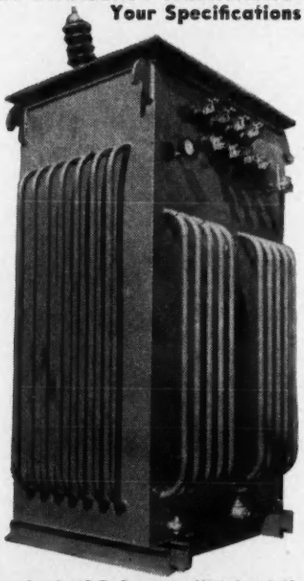
SINGLE PHASE (60 CYCLE)

Qn.	KVA	Make	Type	Rating
2	500	G.E.	H-D	30000/460
6	75	G.E.	H-D	33000/2300
3	75	G.E.	H-D	33000/230/460
6	50	G.E.	H-D	33000/2300/460
3	25	Whse.	H-D	33000/230/460
3	300	Pitts.	ODSC	23000/2300/460
8	75	Whse.	SK	23000/2300
6	37½	Whse.	SK	23000/2300
3	25	G.E.	H	23000/2300
10	400	G.E.	A-L	13200/2400
6	400	G.E.	A-L	13200/600
3	100	Packard	OISC	1200/460
6	50	G.E.	H-KR	6900/230/460
9	25	G.E.	H-D	6900/2300
3	15	Pitts.	OISC	6600/2300
3	250	Al.-Ch.	OISC	2300/230/460
30	37½	Wag.	HE.	2300/115/230
21	25	G.E.	H-K	2300/115/230
50	15	G.E.	H-K	2300/115/230
30	15	Whse.	S	2300/115/230
27	10	G.E.	H-K	2300/115/230
40	10	Whse.	S	2300/115/230
90	7½	G.E.	H-K	2300/115/230
250	5	G.E. and Whse.		2300/115/230

THREE PHASE (60 CYCLE)

2	450	G.E.	H	6900/230/460
3	600	G.E.	H	2300/230/460
1	600	Whse.	SCT	26400/2300

We Are Equipped to Manufacture Power and Distribution Transformers to Your Specifications



One of a bank of 3 Gregory "Hi-Grade" transformers in a recent shipment, completed from top connection to base in the Gregory transformer plant. Shown is 500 KVA Type A, single phase, 60 cycle, 230/460/33,000 V.

NEW

GREGORY "HI-GRADE" AIR COOLED AND OIL COOLED TRANSFORMERS ARE MANUFACTURED IN ALL VOLTAGES, CAPACITIES AND FREQUENCIES.

MOTORS

A. C. SQUIRREL CAGE

3 PHASE—60 CYCLE

1	200	Whse.	CS	220/440	720
1	200	G.E.	IK	220/440	600
1	125	Al.-Ch.	ARW	220/440	350
1	75	Whse.	CS	220/440/2200	400
1	75	Wag.	31V 84RN	220/440	514
1	75	G.E.	KT	220/440/22	120000

A. C. SLIP RING

3 PHASE—25 CYCLE

1	650	Whse.	CW	440	365

A. C. SLIP RING

3 PHASE—60 CYCLE

1	200	G.E.	IM	220/440	600
1	200	G.E.	MT	220/440	720
1	175	Lincoln-Fr. IXV		220/440	600
1	150	G.E.	IM	220/440	450
1	150	G.E. 3-brg.	IM	220/440	600
1	125	G.E.	IM	220/440	600

A. C. SYNCHRONOUS

1—225 H.P. G. E., type ATB 3/60/220/440 V., 600 R.P.M.
1—220 H.P. G.E., type ATI, .8 p.f., 3/60/240/480 V., 720 R.P.M.
1—50 H.P. Elec. Machy., .8 p.f., 3/60/440/2400 V. 400 r.p.m.

A. C. SINGLE PHASE—60 CYCLE

1	10	Century	RS	110/220	900
1	15	Wagner	BA	110/220	900
1	25	Century	RS	110/220	1200

GENERATORS

ALTERNATORS

1—225 KVA G.E. type ATB 3/60/220/440 V., 600 R.P.M.
1—187½ K.W. Gen. Elec. .8 p.f. type ATI. dir. conn. exciter, 3/60/240/480 V. 720 r.p.m.
1—150 KVA G.E., type ATB, 3/60/240/480/2300 V., 600 R.P.M.
1—150 KVA Allis Chalmers, 3/60/2300 V. 900 r.p.m. with belted exciter.
1—37½ KW Elec. Mchy. .8 p.f. 3/60/240/480/2400 V. 400 r.p.m. with belted exciter .
2—30 KW Gen. Elec., type ATB, p.f. .75, 3/60/220 V., 720 r.p.m. with dir. conn. exciter.

M. G. SETS

1—3 K.W. Hertner, 110 V. D.C. vertical dir. conn. to 7 H.P. 3/60/220/440 V. 1800 r.p.m.
1—40 K.W. Gen. Elec., type CL, 125 V. D.C. dir. conn. to 60 H.P. Gen. Elec. 3/60/440/2300/4000 V. 900 r.p.m.
1—50 K.W. Allis Chalmers, 250 V. D.C. dir. conn. to 75 H.P. Westinghouse 3/60/220/440 V. 900 r.p.m.
1—60 K.W. G.E. type DLC, 250 V., comp. wound dir. conn. to 125 K.W. G.E. type ATI; .8 p.f., 240/480 volts, 720 r.p.m.
1—100 KW Gen. Elec., 125 volts, dir. conn. to 150 H.P. Gen. Elec., 3/60/2300 V., synchronous motor.
1—150 K.W. Wstghse. Rotary Converter, 250 V. D.C. complete with transformer, starting equipment and D.C. panel.
1—200 K.W. Wstghse. Rotary Converter, 250 V. D.C. complete with transformer, starting equipment and D.C. panel.
1—300 K.W. Allis Chalmers, 600 V. D.C. dir. conn. to Allis Chalmers synchr. 2 bearing unit, 3/60/2300 V. 600 r.p.m.

CIRCUIT BREAKERS

2—400 Amp. G.E. 3 pole, type FKO366AS, 25000 maximum voltage.
1—400 Amp. West., 3 pole, Type GI, 37000 maximum voltage.
1—600 Amp., West., 3 pole, Type 0221, Style SO21E314, 15,000 maximum voltage. Interrupt. cap. 350000 KVA equipped with automatic equipment.

All of the above circuit breakers are oil cooled, outdoor type, mounted on steel supporting framework. Additional specifications on request.

SWITCHES

SAFETY SWITCHES. LARGE ASSORTMENT. ALL SIZES. 2 AND 3 POLE AT VERY ATTRACTIVE PRICES.

SWITCHBOARDS

A.C. AND D.C. BUILT TO SPECIFICATIONS. A LARGE STOCK OF A.C. AND D.C. SWITCHBOARD INSTRUMENTS AND CURRENT TRANSFORMERS.

METERS

WATT HOUR METERS. SINGLE PHASE, POLYPHASE, D.C., ALL MAKES AND CAPACITIES.

FRE. CHANGERS

1—200 KW G.E. type ATB 3/60/2300 dir. conn. to 300 H.P. G.E. type IK, 3/25/2300, 750 R.P.M.
2—200 KVA G.E., 3/60/2300, 750 R.P.M. dir. conn. to 290 HP G.E. type ATB 3/25/2300 synchronous.

OIL FILTERS

1—Diesel Service Co. — RENUOIL Purifier, Type A, 25 g.p.hr., complete with agitator. Thermostatically controlled.

MANY MORE ITEMS

These listings are only a small fraction of our stock. Let us know your requirements. All inquiries will receive prompt and courteous replies.

PHONE • WIRE • WRITE

GREGORY ELECTRIC

GREGORY ESTABLISHED 1893 Hi-Grade Rebuilt

2636 S. WABASH AVENUE, CHICAGO, ILLINOIS

Alphabetical Index to Advertisers

Acme Electric & Mfg. Co..... 201
*Acme Wire Co..... 196
Air Preheater Corp., The..... 71
*Allis-Chalmers Mfg. Co.....10, 11
Aluminum Co. of America..... 73
*American Brass Co..... 82
American Fork & Hoe Co..... 209
*American Transformer Co..... 181
Anaconda Wire & Cable Co..... 75

Babcock & Wilcox Co.....44, 45
Barker & Wheeler..... 208
*Biddle Co., James G..... 160
Black & Veatch..... 208
Blaw-Knox Co. 31
Brewer-Titchener Corp. 16, 17
Broadway Maintenance Corp..... 208
Brooks Sprinkling Systems..... 162
*Bull Dog Electric Products Co.... 55
*Burndy Engineering Co..... 7
*Bussmann Mfg. Co.....32, 33

Central Railway Signal Co., Inc... 190
*Chance Co., A. B..... 184
Cheney & Co., E. J..... 208
Columbia Engrg. Co..... 208
Columbia Gas & Electric Corp.... 34
Consolidated Treating Co..... 153
*Continental-Diamond Fibre Co.... 183
Cooper & Co., Hugh L..... 208
*Cornell-Dubilier Electric Corp.... 151
Corning Glass Works.....56, 57
*C-O-Two Fire Equipment Co..... 166
Crescent Insulated Wire & Cable Co. 20
Crescent Tool Co..... 50
Crocker-Wheeler Electric Mfg. Co. 155

Day & Zimmermann, Inc..... 208
De Laval Separator Co., The..... 66
Delta-Star Electric Co.....28, 29
Directory of Engineers..... 208
Doble Engineering Co..... 200
*Dow Chemical Co..... 159
*Dunn, Inc., Struthers..... 76

*Electric Power Equipment Corp... 205
Electric Storage Battery Co..... 25
*Electrical Engineers Equipment Co. 12, 13
Electrical Testing Laboratories Inc. 208
Elliott Company 6
Engineers, Directory of..... 208
Essell Eng'r Co..... 208
Everstick Anchor Co..... 204

*Fargo Mfg. Co..... 190
*Fast & Co., John E..... 14
Federal Electric Products Co..... 167
Ferguson, H. F..... 208
*Fleur-O-Lier Manufacturers 177
Foley Construction Corp., Robert E. 208
Ford, Bacon & Davis, Inc..... 208
Foster Wheeler Corp..... 41
*Four Wheel Drive Auto Co..... 15
Fowle & Co., Frank F..... 208

G & W Electric Specialty Co..... 51
General Cable Corp.....64, 65
*General Electric Co....22, 23, 135, 136 137, 138, 140 141, 171
General Electric Co., Air Conditioning and Commercial Refrigeration Dept. 48
Gilbert Associates, Inc..... 208
Gould Storage Battery Corp..... 74
*Graybar Electric Co..... 19
*Greenlee Tool Co..... 192
Gulf Oil Corp..... 59
*Guth Co., The Edwin F..... 174

Harper Co., The H. M..... 180
Hartford Electric Light Co..... 200
*Hazard Insulated Wire Works....4, 5
Henkels & McCoy..... 208
Hoosier Engineering Co.....169, 208
Hotpoint 37
Hubbard & Co..... 179

*Ilsco Copper Tube & Products, Inc. 204
*Imperial Porcelain Works..... 201
Indiana Steel & Wire Co..... 168
*I-T-E Circuit Breaker Co...Third Cover

*Johns-Manville 198, 199

*Kearney Corp., James R.....78, 79
*Kuhlman Electric Co.....Back Cover

*Lapp Insulator Co..... 39
*Leeds & Northrup Co..... 72
Leffler, William S..... 208
Line Material Co.....147, 148, 190
*Locke Insulator Corp.....68, 69

Main, Inc., Chas. T..... 208
Malleable Iron Fittings Co..... 201
Mallory & Co., Inc., P. R..... 40
Manning & Co., J. H..... 208
*Marathon Chemical Co..... 209
Matthews Corp., W. N..... 21
McGraw-Hill Book Co.....188, 192
Mead, Daniel W..... 208
*Metropolitan Device Corp. Second Cover
*Moloney Electric Co..... 30
Mullergren, Arthur L..... 208

National Electric Products Corp... 86
National Telephone Supply Co.... 195
*Newport News Shipbuilding & Dry Dock Co. 58

Ohio Brass Co.....8, 9
*Okonite Co.....4, 5
*Okonite-Callender Cable Co.....4, 5
*Oliver Iron & Steel Corp..... 161

*Pacific Electric Mfg. Corp..... 24
Palnut Company, The..... 172
*Pennsylvania Transformer Co..... 52
*Penn-Union Electric Corp..... 186
Philadelphia Gear Works..... 193
Pittsburgh Reflector Co..... 176

*Railway & Industrial Engineering Co. 35, 36
RCA Mfg. Co., Inc..... 173
Recording & Statistical Corp..... 208
*Reliable Electric Co..... 197
Remington Rand, Inc..... 187
Revere Copper and Brass Inc..... 143
*Rockbestos Products Corp..... 189
*Roller-Smith Co. 164, 165
Rome Cable Corp..... 77
*Rusgreen Mfg. Co..... 206

Sanderson & Porter..... 208
*Sangamo Electric Co..... 81
Sargent & Lundy..... 208
Schaub Engineering Co., Fred H.. 188
Scheidenhelm, F. W..... 208
Schweitzer & Conrad, Inc.....42, 43
Searchlight Section...210, 211, 212, 213 214, 215
Simplex Wire & Cable Co..... 18
*SKF Industries, Inc..... 61
Smith Co., S. Morgan..... 27
*Southern States Equipment Corp.. 145
Spooner & Merrill, Inc..... 208
Square D Co..... 49
*Stackpole Carbon Co..... 70
*Standard Transformer Co.....46, 47
*Star Porcelain Co., The..... 206
*Sticht Co., Inc., Herman H..... 196
Stone & Webster Engrg. Corp..... 208
*Sylvania Electric Products Inc.... 60

Texas Co., The..... 83
Thomas & Betts Co., The..... 67
Timber Engineering Co..... 191
Trico Fuse Mfg. Co..... 201
*Trumbull Electric Mfg. Co., The.. 157

*United States Steel Corp..... 80
United States Steel Supply Co..... 80
*Uptegraff Mfg. Co., R. E..... 175

Wagner Electric Corp..... 38
Welsbach Engrg. & Mgt. Corp..... 208
*Westinghouse Elec. & Mfg. Co.... 62 63, 84, 85, 163
West Virginia Pulp & Paper Co... 196
White Engineering Corp., J. G... 208
Worthington Pump & Machinery Corp. 185
*Wright & Sons Co., Wm. E..... 26

■

PROFESSIONAL SERVICES 208

■

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT SERVICE 210
POSITIONS VACANT 210
POSITIONS WANTED 210
WANTED TO PURCHASE.....214
USED AND SURPLUS EQUIPMENT.....211-215

Belyea Co., Inc.....213
Chicago Electric Co.....212
Electric Equipment Co.....214
Electric Service Co., The.....214
Erie Electric Co.....214
Gregory Electric 215
Hemphill & Co., L. J.....211
Hudson, Town of.....214
Iron & Steel Products Inc.....214
Ross Power Equipment Co.....214

★ **These companies have supplied additional buying information on their products in the 1943 edition of the Electrical Buyers' Reference.**

TYPE ET-20 *Thermal* Circuit Breakers

Do you know how useful TYPE ET-20 is?

With main feeder distribution circuits heavily loaded as they now are, there is need for high interrupting capacity. Type ET meets this need with

interrupting rating of 25,000 amperes.

FIG. 1

Changeovers in industrial operations call for flexibility in the current ratings of circuit protective devices. For this need, the Type ET circuit breakers have

interchangeable trip units

with continuous ratings ranging up to 600 amperes. Trip units are very easily changed.

To meet a variety of requirements, Type ET-20 circuit breakers are available with

undervoltage trip and shunt trip

Provision is made for auxiliary switches with one "a" and one "b" contact and overcurrent bell alarm switches.

Avoidance of needless power interruption was never more important than it is now. Inherent time-delay incorporated in Type ET-20, permits continuous service unaffected by harmless overloads. Tripping mechanisms have true

inverse-time characteristics

—the greater the need for opening the circuit, the more quickly it is accomplished. Heavy overloads and short circuits trip the breaker instantaneously.

Type ET-20 circuit breakers are extremely compact. Over-all case dimensions are 19½ x 9 x 6 inches.

Space is saved.

Design of the Type ET-20 provides maximum ruggedness with minimum material.

Critical materials are saved.

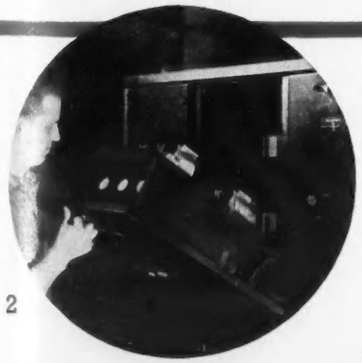


FIG. 2

Type ET-20 circuit breakers, shown in Fig. 2 mounted in a withdrawal type switchboard and in Fig. 3 in an individual steel enclosure, are installed in main feeder distribution circuits, up to 600 volts a-c and 250 volts d-c. They are accurately calibrated at the I-T-E factory. They serve with a very minimum of maintenance.

FIG. 3

AIR SWITCHGEAR

IMMERSED IN AIR — ENCASED IN STEEL

The Army-Navy "E" for Production Excellence

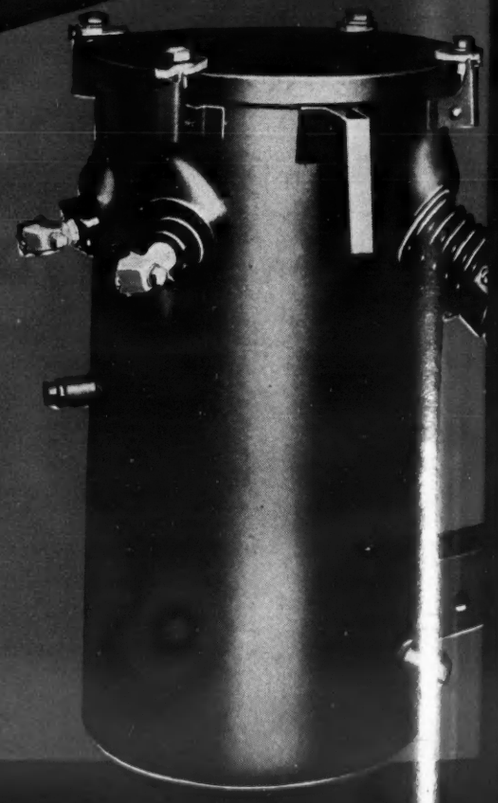
I-T-E CIRCUIT BREAKER CO., PHILADELPHIA, PA.

THE THREE R'S OF KUHLMAN DISTRIBUTION TRANSFORMERS

RUGGED Because of their rugged construction throughout, Kuhlman Distribution Transformers stand up on the job with a minimum of maintenance. Insulation, bushings, tanks, lifting lugs and all component parts are of extra strength to insure uninterrupted, trouble-free performance year after year.

RELIABLE For more than forty-five years Kuhlman has been successfully designing and building good Distribution Transformers. Records of their performance on the job give ample evidence of their reliability under any and all conditions. For reliability it pays to operate Kuhlman Transformers.

REFINED Among the many Kuhlman refinements is the patented B.I. (Bent Iron) core which results in lower exciting currents, reduced weight and better operating characteristics. Pocket Bushing seats pressed into tank, "Quick-Grip" primary bushings and scores of other refinements increase a Kuhlman's efficiency.



KUHLMAN ELECTRIC COMPANY